U.S. DEPARTMENT OF COMMERCE
National Technical Information Service

PB-262 920

Air Pollution Abstracts
41193-42405. Volume 5
Number 11, November 1974

Environmental Protection Agency, Research Triangle Park, N C

Nov 74

PB 262 920

Volume 5, No. 11
November 1974
APABCA-5(11)(1974)
US ISSN 0027-5956

AIR POLLUTION ABSTRACTS

41193-42405

NOVEMBER 1974

U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Air Quality Planning and Standards
Research Triangle Park, N. C. 27711

TECHNICAL REPORT DATA
(Please read Instructions on the reverse before completing)

1. REPORT NO. APABCA-5-11-1974	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Air Pollution Abstracts Volume 5, No. 11		5. REPORT DATE November 1974
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S)		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS Air Pollution Technical Information Center Research Triangle Park, North Carolina 27711		10. PROGRAM ELEMENT NO.
		11. CONTRACT/GRANT NO.
12. SPONSORING AGENCY NAME AND ADDRESS Same		13. TYPE OF REPORT AND PERIOD COVERED
		14. SPONSORING AGENCY CODE

15. SUPPLEMENTARY NOTES

16. ABSTRACT

This periodical is published to inform air pollution personnel of the Environmental Protection Agency (EPA), and others, of technical literature recently accessioned by the Air Pollution Technical Information Center (APTIC). For each accession, its Abstract Number, APTIC accession number, bibliographic citation, and abstract are given. Translations are cited with their sources whenever possible. The subject fields are as follow: Emission Sources; Control Methods; Measurement Methods; Air Quality Measurements; Atmospheric Interactions; Basic Science and Technology; Effects-Human Health; Effects-Plants and Livestock; Effects-Materials; Economic Aspects; Standards and Criteria; Legal and Administrative; Social Aspects; and General and Miscellaneous. All abstracts are listed under one of the above subject fields. A subject and author index are included. This issue contains abstracts 41193 - 42405.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Air pollution Abstracts Information retrieval		13B 5B

18. DISTRIBUTION STATEMENT Unlimited	19. SECURITY CLASS *(This Report)*	21. NO. OF PAGES 263
	20. SECURITY CLASS *(This page)*	22. PRICE 9.00

EPA Form 2220-1 (9-73)

AIR POLLUTION ABSTRACTS

VOLUME 5, NO. 11 NOVEMBER 1974

Prepared by
Air Pollution Technical Information Center (APTIC)
Research Triangle Park, North Carolina 27711

Subscribers receiving 'Air Pollution Abstracts'
directly from the U. S. Government Printing Office
should address any inquiries regarding issues
subsequent to June 1972 to:

U. S. Government Printing Office, Washington, D., C. 20402

The Administrator of the Environmental Protection Agency has determined that the publication of this periodical is necessary in the transaction of public business required by law of this Agency. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through March 31, 1975.

CONTENTS

Introduction 3
APTIC Publications 5
Recent Contract Awards 6
Subject Fields and Scope Notes 10
Abstract Bulletin 13
Subject Index SI-1

The terms that most closely describe the information presented in the documents are arranged alphabetically.

Author Index AI-1

Personal authors are arranged alphabetically. The names are presented last name first. When the author is a primary author, an asterisk precedes the Abstract Number.

INTRODUCTION

This periodical is intended to inform personnel of the Environmental Protection Agency (EPA), and others who are also professionally interested in air pollution, of selected technical literature recently accessioned by the Air Pollution Technical Information Center (APTIC). For each accession, its Abstract Number, APTIC accession number, bibliographic citation, and abstract are given. Semiannual cumulative indexes to both subject and author are also sent to all recipients of this monthly publication.

EPA's staff should direct requests for full text duplicates (if not locally available) to APTIC, using the order form provided. Translations of foreign language documents may be arranged for these personnel upon request. Commercially available translations may also be requested from APTIC.

For non-EPA readers, APTIC can provide copies of only those articles that have been written by EPA's air pollution personnel and have not been published in the open literature. Requests for all other articles should be directed to local libraries, publishers, or authors, with the following exception. Copies of EPA's numbered air pollution technical publications, as indicated in the citation, will be provided, while supplies permit, only to certain qualified requesters, e.g., its current contractors, grantees, and air pollution control agencies; a list of these publications is available. When requesting any publications, please include the complete citation. Translations are cited with their sources whenever possible. If a translation proves to be unavailable from the source cited, or if a translation is cited without a source, it may be located through APTIC or through the National Translations Center, 35 West 33rd Street, Chicago, Illinois 60616. In order to promote scientific and technical progress by facilitating access to each of the abstracted documents, APTIC is assuring that they are also held at EPA Headquarters and at each of the EPA Regional Offices. Information regarding their accessibility may be sought from the libraries there. Their addresses are:

U.S. Environmental Protection Agency
Region I Library
Room 2211-B, JFK Federal Building
Boston, Massachusetts 02203

U.S. Environmental Protection Agency
Region II Library
26 Federal Plaza
Room 908
New York, New York 10007

U.S. Environmental Protection Agency
Region III Library
Curtis Bldg., 6th and Walnut Streets
Philadelphia, Pennsylvania 19106

U.S. Environmental Protection Agency
Region IV Library
1421 Peachtree Street, N.E.
Atlanta, Georgia 30309

U.S. Environmental Protection Agency
Region V Library
1 North Wacker Drive
Chicago, Illinois 60606

U.S. Environmental Protection Agency
Region VI Library
1600 Patterson Street
Dallas, Texas 75201

U.S. Environmental Protection Agency
Region VII Library
1735 Baltimore Avenue, Room 249
Kansas City, Missouri 64108

U.S. Environmental Protection Agency
Region VIII Library
1860 Lincoln Street, Suite 900
Denver, Colorado 80203

U.S. Environmental Protection Agency
Region IX Library
100 California Street
San Francisco, California 94111

U.S. Environmental Protection Agency
Region X Library
1200 Sixth Avenue
Seattle, Washington 98101

U.S. Environmental Protection Agency
Headquarters Library, Room 2404
Waterside Mall
401 M Street, S.W.
Washington, D. C. 20460

When NTIS or DDC or GPO appear at the end of the citation, they designate the sales outlet offering the document. NTIS refers to: National Technical Information Service, U. S. Department of Commerce, 5285 Port Royal Road, Springfield, Virginia 22161, Telephone (703) 321-8543. The designation NTIS is followed by their order number. NTIS sells paper copies at various prices and microfiche at $2.25. If payment does not accompany an order, NTIS will charge an additional $0.50 for each different title that is ordered in paper copy. DDC refers to: Defense Documentation Center, Cameron Station, Alexandria, Virginia 22314. Users registered at DDC may order such documents from them at the same prices as NTIS'. GPO refers to: Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402, Telephone (202) 541-3311. GPO sells paper copies at various prices; GPO does not sell microfiche. Payment must accompany all orders to GPO.

The serial publications (journals, periodicals, etc.) being scanned number approximately 7,000. A list of approximately 1,000 of the most productive publications with the address of each publisher is available upon request.

As another service, abstracts of all of the literature in APTIC (not just in a single issue of this periodical) on any subject related to air pollution will be provided free of charge upon request. APTIC can search information more recent than that in the current issue of this periodical because of the lapse of time entailed by editorial, make-up, and printing work. More than 1400 subject index terms are available for such searching ---more than those included in the subject index in each issue.

Acknowledgement is given to the Technical Publications Branch, Informational Services Division, Office of Administration, Research Triangle Park, N.C. for the make-up of the cover and for arrangement of printing and distribution.

Feedback from our users, including suggestions of articles, are always welcome.

APTIC Publications

Air Pollution Aspects of Emission Sources: Primary Lead Production - A Bibliography with Abstracts, June 1973, GPO No. EP 4.9:126, $0.65.

Air pollution Aspects of Emission Sources: Primary Copper Production - A Bibliography with Abstracts, June 1973 GPO No. EP 4.9:125, $0.70.

Air Pollution Aspects of Emission Sources: Pulp and Paper Industry - A Bibliography with Abstracts, March 1973, GPO No. EP 4.9:121, $2.35.

Air Pollution Aspects of Emission Sources: Primary Aluminum Production - A Bibliography with Abstracts, June 1973, GPO No. EP 4.9:119, $0.90.

Mercury and Air Pollution: A Bibliography with Abstracts, October 1972, GPO No. EP 4.9:114, $1.25.

Odors and Air Pollution: A Bibliography with Abstracts, October 1972, GPO No. EP 4.9:113, $3.00.

Air Pollution Aspects of Emission Sources: Petroleum Refineries - A Bibliography With Abstracts, July 1972, GPO No. EP 4.9:110, $1.25.

Air Pollution Aspects of Emission Sources: Iron and Steel Mills - A Bibliography With Abstracts, May 1972, GPO No. EP 4.9:107, $1.00.

Air Pollution Aspects of Emission Sources: Boilers - A Bibliography With Abstracts, May 1972, GPO No. EP 4.9:105, $2.00.

Hydrochloric Acid and Air Pollution: An Annotated Bibliography, July 1971, GPO No. EP 4.9:100, $0.55.

Chlorine and Air Pollution: An Annotated Bibliography, July 1971, GPO No. EP 4.9:99, $0.55.

Air Pollution Aspects of Emission Sources: Electric Power Production - A Bibliography With Abstracts, May 1971, GPO No. EP 4.9:96, $2.25.

Air Pollution Aspects of Emission Sources: Cement Manufacturing - A Bibliography With Abstracts, May 1971, GPO No. EP 4.9:95, $0.50.

Air Pollution Aspects of Emission Sources: Sulfuric Acid Manufacturing - A Bibliography With Abstracts, May 1971, GPO No. EP 4.9:94, $0.65.

Air Pollution Aspects of Emission Sources: Nitric Acid Manufacturing - A Bibliography With Abstracts, May 1971, GPO No. EP 4.9:93, $0.45.

Air Pollution Aspects of Emission Sources: Municipal Incineration - A Bibliography With Abstracts, May 1971, GPO No. EP 4.9:92, $1.00.

Photochemical Oxidants and Air Pollution: An Annotated Bibliography (2 Volumes), March 1971, GPO No. EP 4.9:88, $6.25.

Beryllium and Air Pollution: An Annotated Bibliography, February 1971, GPO No. EP 4.9:83, $0.40.

Asbestos and Air Pollution: An Annotated Bibliography, February 1971, GPO No. EP 4.9:82, $0.50.

Municipal Incineration: A Review of Literature, June 1971, GPO No. EP 4.9:79, $1.00.

Hydrocarbons and Air Pollution: An Annotated Bibliography (2 Volumes), October 1970, GPO No. HE 20.1309:75, $5.00.

The acronym GPO which appears in the above listing refers to: Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Orders should be directed to GPO only; payment must accompany all orders.

RECENT CONTRACT AWARDS

from the

Durham Contract Operations
Contracts Management Division, EPA

Contract No. 68-02-1483, RFP No. Du-74-A093 .... *$153,542*
MODELING OF AIR QUALITY IMPACT OF SELECTED POWER PLANTS.
Geomet, Incorporated, 50 Monroe Street, Rockville, Maryland 20850

Contract No. 68-02-1484, RFP No. Du-74-A093 .... *$134,078*
MODELING OF AIR QUALITY IMPACT OF SELECTED POWER PLANTS.
Walden Research Division of Abcor, Inc., 201 Vassar Street, Cambridge, Massachusetts 02139

Contract No. 68-02-1835, RFP No. Du-74-A139 .... *$104,173*
HYDROCARBON EMISSION REDUCTION FROM ETHYLENE DICHLORIDE PROCESSES.
Allied Chemical Corporation, P. O. Box 1057 R, Morristown, New Jersey 07960

Contract No. 68-02-1485, RFP No. Du-74-A283 .... *$50,000*
PARAMETRIC STUDIES OF THE PRODUCTION OF STORABLE CLEAN FUELS FROM AGRICULTURAL, FORESTRY AND ANIMAL WASTES.
Georgia Tech Research Institute, Georgia Institute of Technology, 305 Administration Building, Atlanta, Georgia 30332

Contract No. 68-02-1802, RFP No. Du-74-A192 .... *$195,862*
EVALUATION OF VENTURI SCRUBBER SYSTEMS FOR CONTROL OF PARTICULATE EMISSIONS FROM A COAL FIRED UTILITY BOILER.
Meteorology Research, Inc., 464 West Woodbury Road, Altadena, California 91001

Contract No. 68-02-1814, RFP No. Du-74-A303 .... *$1,290,998*
PROTOTYPE STUDY OF LIME AND LIMESTONE SCRUBBERS FOR SO2 AND DUST REMOVAL.
Bechtel Corporation, Fifty Beale Street, San Francisco, California 94119

Contract No. 68-02-1375, Task Order No. 13 .... *$187,000*
CONDUCT OF THE GREAT PLAINS MONITORING STUDY.
PEDCo-Environmental Specialists, Inc., Suite 13, Atkinson Square, Cincinnati, Ohio 45246

Contract No. 68-02-1808, RFP No. Du-74-X001 .... *$242,506*
DIRECT COAL BURNING FUEL CELL.
Stanford Research Institute, Menlo Park, California 94025

Contract No. 68-02-1490, RFP No. Du-74A244 .... *$204,527*
FINE PARTICLE CHARGING SYSTEM DEVELOPMENT.
Southern Research Institute, 2000 Ninth Avenue South, Birmingham, Alabama 35205

Contract No. 68-02-1074, RFP No. Du-74-A261 .... *$221,100*
PARTICLE SIZE DISTRIBUTION ANALYSIS AND IDENTIFICATION AND QUANTIFICATION OF GASEOUS AND PARTICULATE TOXIC AND HAZARDOUS EMISSIONS FROM OIL AND OIL-FIRED INDUSTRIAL BOILERS.
KVB Engineering, Inc., 17332 Irvine Boulevard, Tustin, California 92680

Contract No. 68-02-1695, RFP No. Du-74-C877 .... *$33,155*
PARTICLE SIZING MONITOR.
Environmental Systems Corporation, P. O. Box 2525, Knoxville, Tennessee 37901

Contract No. 68-02-1738, RFP No. Du-74-B467 .... *$198,017*
CHROMOSOMAL ABNORMALITIES ASSOCIATED WITH KNOWN LOW LEVEL OCCUPATIONAL OZONE EXPOSURES IN WELDER TRAINEES.
Columbia University, College of Physicians and Surgeons, 630 West 168th Street, New York, N. Y. 10032

Contract No. 68-02-1753, RFP No. Du-74-B419 .... *$48,325*
STUDY TO DEVELOP MODIFICATIONS OF THE STANDARD MULTIPLE-SOURCE GAUSSIAN-PLUME URBAN DISPERSION MODEL, CAPABLE OF UTILIZING MULTIPLE-STATION INFORMATION ON WIND SPEED AND DIRECTION.
Environmental Research & Technology, Inc., 429 Marrett Road, Lexington, Massachusetts 02173

Contract No. 68-02-1099, Modification No. 4 .... *$220,769*
ADDITIONAL WORK FOR A STUDY OF FUEL GAS (LOW BTU) CLEAN UP SYSTEMS IN INTEGRATED COMBINED CYCLE PLANTS.
United Aircraft Corporation, Research Laboratories, 400 Main Street, East Hartford, Connecticut 06180

Contract No. 68-02-1723, RFP No. Du-74-B430 .... *$108,022*
THE EFFECTS OF LOW LEVELS OF NO2, O3, AMBIENT AIR ON CARDIAC PULMONARY AND PERIPHERAL CIRCULATORY FUNCTION IN ADULT MALES.
The Regents of the University of California, University of California, Santa Barbara, California 93106 (NOTE: Contract contains option in the amount of $98,520)

Contract No. 68-02-1826, RFP No. Du-74-A081 .... *$41,079*
SITE SELECTION FOR AMBIENT AIR MONITORING.
Environmental Research & Technology, Inc., 429 Marrett Road, Lexington, Massachusetts 02173

Contract No. 68-02-1375, Task Order No. 15 .... *$30,000*
AMBIENT AIR QUALITY MONITORING AT GARFIELD, UTAH SMELTER.
PEDCo-Environmental Specialists, Inc., Suite 13, Atkinson Square, Cincinnati, Ohio 45246

Contract No. 68-02-1747, RFP No. Du-74-B547 .... *$93,100*
DRY DEPOSITION MEASUREMENT MODELING FOR FOSSILO FUEL EFFLUENTS.
Battelle Memorial Institute, Pacific Northwest Laboratories, P. O. Box 999, Richland, Washington 99352

Contract No. 68-02-0758, RFP No. Du-74-B469 and RFP No. Du-74-B470.... *$643,800*
MOBILE AIR MONITORING FIELD STATIONS.
Rockwell International Corporation, Science Center, P. O. Box 1085, Thousand Oaks, California 91360 (NOTE: Contract contains options in the amount of $954,682 for portable air monitors and addition of aerosol monitoring instruments to existing CHAMP stations)

Contract No. 68-02-1451, RFP No. Du-74-A076 .... *$332,629*
BATCH PRESSURIZED COMBUSTION/DESULFURIZATION VARIABLE STUDY.
Exxon Research & Engineering Company, P. O. Box 8, Linden, New Jersey 07036

Contract No. 68-02-1353, Modification No. 3 .... *$96,700*
EVALUATION OF CONTROL TECHNIQUES FOR EMISSIONS FROM ENCLOSED ASBESTOS SOURCES.
IIT Research Institute, 10 West 35th Street, Chicago, Illinois 60616

Contract No. 68-02-1473, RFP No. Du-74-A082 .... *$264,000*
PERFORMANCE OF STUDIES OF AIR POLLUTION CONTROL TECHNOLOGY AND COSTS FOR SELECTED SOURCES.
Industrial Gas Cleaning Institute, Inc., P. O. Box 1333, 999 Bedford Street, Stamford, Connecticut 06904 (NOTE: Contract contains option in the amount of $36,710)

Contract No. 68-02-1825, RFP No. Du-74-X002 .... *$66,055*
EVALUATION AND OPTIMIZATION OF FUEL CELL PROGRAM.
Burns and Roe, Inc., 700 Kinderkamack Road, Oradell, New Jersey 07649

Contract No. 68-02-1498, RFP No. Du-74-A246 .... *$199,930*
EXTENSION OF APPLICATION OF COMBUSTION MODIFICATION TECHNIQUES TO PACKAGE BOILERS.
Ultrasystems, Inc., 500 Newport Center Drive, Newport Beach, California 92660

Contract No. 68-02-1379, Task Order No. 1 .... *$65,000*
INSTALLATION OF EIS/CDHS FOR REGION IV AGENCIES.
IBM Corporation, Federal Systems Division, 18100 Frederick Pike, Gaithersburg, Maryland 20760

Contract No. 68-02-1719, RFP No. Du-74-B419 .... *$45,700*
HYDROCARBON COMPOSITION CHANGES UPON THE OXIDANT-HC RELATIONSHIP.
Esso Research & Engineering Company, P. O. Box 172, Linden, New Jersey 07036

Contract No. 68-02-1379, Task Order No. 2 .... *$60,000*
INSTALLATION OF AQDHS/CDHS FOR REGION IV STATE AGENCIES.
IBM Corporation, Federal Systems Division, Federal Systems Center, 18100 Frederick Pike, Gaithersburg, Maryland 20760

Contract No. 68-02-1745, RFP No. Du-74-B515 .... *$211,354*
EFFECT OF NO2 ON LUNG FUNCTION IN HUMAN SUBJECTS WITH ASTHMA AND CHRONIC BRONCHITIS.
University of Maryland, 660 West Redwood Street, Baltimore, Maryland 21201

Contract No. 68-02-1687, RFP No. Du-74-B521 .... *$44,351*
PREPARATION AND CHARACTERIZATION OF FINELY PARTICULATE ENVIRONMENTAL CONTAMINANTS FOR BIOLOGICAL EXPERIMENTATION.
IIT Research Institute, 10 West 35th Street, Chicago, Illinois 60607

Contract No. 68-02-1491, RFP No. Du-74-A157 .... *$87,850*
DEMONSTRATION FEASIBILITY FOR PERMANENT CONTROL OF NON-FERROUS SMELTERS.
Research Triangle Institute, P. O. Box 12194, Research Triangle Park, North Carolina 27709

Contract No. 68-02-1360, Modification No. 3 .... *$121,787*

DESIGN PRINCIPLES FOR THE CONTROL OF POLLUTANT EMISSIONS FROM THE COMBUSTION OF LOW-BTU GAS.

Institute of Gas Technology, 3424 South State Street, IIT Center, Chicago, Illinois 60616

SUBJECT FIELDS AND SCOPE NOTES

1. EMISSION SOURCES

Information pertaining to an industry, process, or material associated with air pollution. Documents in this category are concerned primarily with characteristics of a specific class of emission sources including types, rates, industries; secondary coverage may include effects, control methods, etc.

2. CONTROL METHODS

Includes equipment and both specific source control and general abatement efforts. Included are documents describing the operating principles, design, operation, efficiency, etc., of equipment and methods of removing pollutants. The scope of the document can vary from a device for a specific source to an approach applicable to an entire industry--e.g., automobiles.

3. MEASUREMENT METHODS

Includes equipment as well as methods. Confined to development testing and evaluation of pollutant determination methods (sampling, analytical, monitoring) and equipment, as such. Data obtained by use of methods in specific applications are placed in the applicable subject categories.

4. AIR QUALITY MEASUREMENTS

Pollution measurements in the ambient air, generally related to specific geographical locations, such as area surveys. Also includes general reviews of area situations and emission source inventories.

5. ATMOSPHERIC INTERACTION

All chemical and physical phenomena occurring in the atmosphere Included is material on dispersion, air pollution forecasts, meteorological effects, topographical effects, photochemical reactions in the atmosphere, etc. Laboratory studies of photochemical reactions are assigned to Basic Science and Technology.

6. BASIC SCIENCE AND TECHNOLOGY

General discussions or data compilations for the basic physical and chemical properties of pollutants. Theoretical and laboratory studies on related chemical and biological reactions and mechanisms. Mass transfer and other basic knowledge related to process engineering applications in emission control or abatement. Excludes photochemical studies in the atmosphere and biochemical studies related to effects of air pollution.

7. EFFECTS--HUMAN HEALTH

Covers medical and epidemiological studies; biological effects other than those on plants and livestock produced by air pollutants; laboratory animal experiments.

8. EFFECTS--PLANTS AND LIVESTOCK

Effects on vegetation--crops, trees, other plants--and on livestock as distinguished from laboratory experimental animals.

9. EFFECTS--MATERIALS

Deterioration, corrosion, etc., of physical materials, buildings, and structures.

10. ECONOMIC ASPECTS

Economic implications of air pollution and its control, e.g., economic losses from pollution damage, and costs of control programs or equipment in general.

11. STANDARDS AND CRITERIA

Recommended or adopted guides, criteria and standards for allowable emission limits or pollutant concentrations, air quality, equipment characteristics, and fuels.

12. LEGAL AND ADMINISTRATIVE

Legal aspects include legislation, ordinances, rules, litigation, hearings, decisions, etc. Administration covers administrative and miscellaneous information concerning control agencies and control and research programs. Typical topics are personnel, budgets, contractual activities and program descriptions.

13. SOCIAL ASPECTS

Sociological and psychological aspects such as social attitudes public opinion studies, public relations, and public information.

14. GENERAL AND MISCELLANEOUS

Reviews of general problems, trends and background. Documents not assignable to other categories.

ABSTRACT BULLETIN

EMISSION SOURCES

1974

41193 **APTIC NO. 65799**

Bates, Charles E. and Lester D. Scheel

PROCESSING EMISSIONS AND OCCUPATIONAL HEALTH IN THE FERROUS FOUNDRY INDUSTRY. *Amer. Ind. Hyg. Assoc. J., 35(8):452-462, Aug. 1974. 36 refs.*

A summary is given of the available information about ferrous foundry effluent produced during melting, pouring, and casting shakeout. Some decomposition products of four types of organic foundry mold resins have been identified using gas chromatographic and infrared methods. The survey may provide some insight into the types of materials that should be considered when making an industrial hygiene survey of foundry operations. Melting furnace emissions include: carbon dioxide, carbon monoxide, sulfur dioxide, nitrogen, oxygen, inorganic particulates, and organic particulates from cupola iron melting; CO, dust, and fumes from electric arc steel melting; and fumes and organic particulates from electric furnace iron melting. Molding, pouring, and shakeout emissions include dusts, organic green sand additives, organic materials from mold heating, various gases formed by resin decomposition, and odors. (Author abstract modified)

41194 **APTIC NO. 63668**

Buchheim, Rolf

EMISSION PROPERTIES OF THE PASSENGER CAR TURBINE VW-GT 70. *(Das Emissions-verhalten der Personenwagen-Gasturbine VW-GT 70). Text in German. Motortech. Z. (Duesseldorf), 35(3):80-87, 1974. 27 refs.*

The stationary and nonstationary emissions of a VW-GT 70 gas turbine were determined. For the measurement of stationary emissions on a dynamometer, infrared gas analyzers were used for carbon monoxide and dioxide, a chemiluminescence analyzer for the oxides of nitrogen, and a flame ionization detector for the hydrocarbons. The results confirmed the findings of earlier investigations with gas turbines for airplanes and trucks. For the CO and HC emissions neutral is particularly critical, while the concentration of the NOx is particularly high during full load operation. The methods for testing nonstationary emissions have been developed for piston engines and cannot be applied to gas turbines without modifications. The problems of applying the Europe and California tests and constant volume sampling to the gas turbine are discussed. The test methods require modifications, particularly with regard to measurements of the HC emissions. The results with the VW gas turbine have shown that the gas turbine has favorable CO and HC emissions. The emission of NOx by the present combustion chamber is to a high by a factor four to six, particularly with regard to the U. S. standards of 1976. Through design modification of the combustion chamber these emissions can be lowered too. In order to become competitive with the piston engine, however, many obstacles, such as high manufacturing costs, low reliability, and high fuel consumption, have to be overcome.

41195 **APTIC NO. 64145**

Challis, E. J.

THE APPROACH OF INDUSTRY TO THE ASSESSMENT OF ENVIRONMENTAL HAZARDS. *Proc. Roy. Soc. London, Ser. B., vol. 185:183-197, 1974*

Environmental hazards arising in manufacture, product testing, and waste disposal are reviewed for the chemical industry in England. Airborne contaminants cited include chlorinated hydrocarbon insecticides and ammonia. Stages of developing and registering a new chemical product are schematically illustrated, with the extended time scales needed to ensure that all known aspects of environmental impact have been covered being projected to result in a decrease in the rate of introduction of new chemicals during the next decade. The effect of new plant installation on the pollution index is tabulated for various chemical pollutants, including such air contaminants as nitric acid, sulfuric acid, and ammonia. The extra costs of equipment needed to meet higher environmental standards are graphically illustrated with particular reference to dust control.

41196 **APTIC NO. 64051**

Grantham, John B., Eldon M. Estep, John M. Pierovich, Harold Tarkow, and Thomas C. Adams

ENERGY AND RAW MATERIAL POTENTIALS OF WOOD RESIDUE IN THE PACIFIC COAST STATES--A SUMMARY OF A PRELIMINARY FEASIBILITY INVESTIGATION. *Dept. of Agriculture, Portland, Ore., Pacific Northwest Forest and Range Experiment Station, Ore., Forest Service General Technical Rept. PNW-18, 38p., 1974. 24 refs.*

Air pollution problems associated with the application of wood residues as an energy source are discussed. Substantial modification in boiler design is necessary to accommodate wood as the sole fuel or in combination with conventional fuel. Because of the lower carbon content, the potential for fly ash emission is greater when wood is burned unless the boiler is equipped with adequate air pollution control equipment. In the gasification of 1 dry ton of bark, 200,000 cu ft of gas is obtained with 40-50% of the fuel value of natural gas and a high carbon monoxide content. This gas cannot be used for conventional municipal or residential purposes since state laws limit the maximum CO content in fuel gas. Gasification is not complete and about 30% of the initial substance weight is converted to char. In a direct heating process of residues in a fluidized bed reactor, the char formed in pyrolysis is gasified by the water gas reaction. Although the same amount of power produced as by directly burning 20 dry tons of wood residue, the fly ash problems are considerably minimized.

41197 **APTIC NO. 64040**

Grobman, Jack and Robert D. Ingebo

FORECAST OF JET ENGINE EXHAUST EMISSIONS FOR FUTURE HIGH ALTITUDE COMMERCIAL AIRCRAFT. *National Aeronautics and Space Administration, Cleveland, Ohio, Lewis Research Center, NASA TM X-71509, 32p., 1974. 35 refs. (Presented at the Dept. of Transportation, Climatic Impact Assessment Program, Conference, 3rd, Cambridge, Mass., Feb. 26-March 1, 1974.)*

Projected minimum levels of engine exhaust emissions that may be realistically predicted for future commercial aircraft

Preceding page blank

cruising within the upper troposphere and stratosphere are presented in terms of an emission index, g pollutant/kg fuel. Emission forecasts include estimates for oxides of nitrogen, carbon monoxide, total hydrocarbons, particulates (soot), sulfur dioxide, total trace elements, carbon dioxide, and water. The forecasts are based on current knowledge of emission characteristics of combustors and augmentors; the current status of combustion research in emission reduction technology; and predictable trends in combustion systems and operating conditions as required for projected engine designs that are candidates for advances subsonic or supersonic commercial aircraft. There are two sets of predictions which are in general agreement; one based on an independent NASA study and the other on the consensus of an ad hoc committee composed of industry, university, and government representatives.

41198 **APTIC NO. 63868**

Gromotka, Hubert

NOVEL METHODS FOR THERMAL TREATMENT OF HAZARDOUS INDUSTRIAL WASTE PRODUCTS. *(Neue Verfahren fuer die thermische Behandlung von umweltschaedlichen Industrieabsfaellen). Text in German. Energietechnik, 26(6):131-134, June 1974. 2 refs.*

Rotary kilns are used to incinerate mainly solid matter, but also liquid and pasty refuse. Difficulties occur with the incineration of barrels containing liquid, pasty, or solid waste products which cannot be mixed with each other. Presently the whole barrels are thrown into the rotary kiln after the lid has been opened or a hole pierced into them. This method however, leads to incomplete and discontinuous incineration due to a lack of air, therefore, the evaporation of liquid, pasty and solid waste in absence of air, as well as the evaporation and simultaneous incineration of mixtures of waste with sewage sludge, ash, and sand were examined. A special furnace was constructed for the purpose. The results indicate that for evaporation of liquids in the absence of air, temperatures around 300 C suffice, for pasty and solid wastes the minimum temperature rises. For soot-free incineration of liquid and pasty refuse with higher heating values, temperatures of about 1060 C were required. The addition of pre-dried sludge (to a water content of less than 10%) proved very helpful. A mixing ratio of 1 to 1 can be used. Such methods were found less suitable for sand and fly ash. A better method of disposal of such wastes was deep freezing in liquid nitrogen, granulation of the frozen waste, and supply to the rotary kiln. Control equipment includes electrostatic precipitators, afterburners, wet dust collector, and ash removal devices.

41199 **APTIC NO. 63601**

Haefele, Wolf

ENERGY SYSTEMS. *Bull. Int. At. Energy Agency, 16(1/2):3-48, Feb./April 1974. 35 refs.*

The trends for increased energy demand are discussed for the short range (1970-1985), the medium range (1980-1995), the long range (1990-2050), and thereafter. The problems of the supply of oil and gas, energy demand, energy conservation, importing of oil, nuclear power, regulations on the use of energy, and the equilibrium between environmental and economic requirements are discussed. The modeling of the demand and supply of energy systems is discussed including energy allocation, computer energy, and dynamical energy allocation modeling. Energy resources include fossil fuel (coal, crude oil, natural gas, natural gas liquids, tar-sand oil, and shale oil), uranium and thorium nuclear fission fuel resources, lithium and deuterium resources for fusion, geothermal sources, water and tidal power, and solar power. The feasibility, environmental effects, and advantages and disadvantages of these resources are reviewed. Systems analysis can be used to determine the problems and advantages of these resources. The effects of energy production on the atmosphere are reviewed including possible weather modification caused by power generation. The heat balance of the air, hydrosphere, and water can be affected. The embedding of the use of energy into the ecosphere and the sociosphere can produce serious environmental effects. The commercial power reactors in operation throughout the world are listed in an appendix.

41200 **APTIC NO. 64033**

Hahn, Juergen

THE NORTH ATLANTIC OCEAN AS A SOURCE OF ATMOSPHERIC N2O. *Tellus (Uppsala), 26(1-2):160-168, 1974. 25 refs.*

Nitrous oxide concentrations were measured in marine air and sea water to determine if the North Atlantic Ocean is a source of atmospheric N2O. The average N2O flux from the soil into the atmosphere is 0.5 times 10 to the minus 12th power g/sq cm and second. If this value is considered as a representative average for the land surface of the northern hemisphere, an overall flux from the land into the atmosphere is 0.16 times 10 to the 14th power g N2O/yr. Accordingly, the Northern Atlantic ocean produces nearly as much N2O/yr as does the entire land surface in the northern hemisphere.

41201 **APTIC NO. 64316**

Hartmann, W. D.

SOCIAL ECONOMIC PROBLEMS OF ENVIRONMENTAL PROTECTION AT THE DEVELOPMENT OF TECHNOLOGY. *(Sozialoekonomische Probleme des Umweltschutzes bei der Entwicklung der Technik). Text in German. Technik (Berlin), 29(6):360-363, June 1974. 7 refs.*

Environment polluting technologies are an inheritance from the past. From the beginning of the industrial revolution on up to the present, technologies were developed with the main purpose of increasing the output of consumer goods. The accompanying emission of pollutants has been utterly disregarded. In the United States presently more than 200 million tons of pollutants are thrown into the atmosphere per year. The manufacture of automobiles entirely neglected emissions of combustion products and fuel losses. Tables list the carbon monoxide, nitrogen oxide, hydrocarbon, sulfur dioxide and particulate emissions by automobiles in the Federal Republic of Germany in the years 1959, 1966, 1969, 1975 and 1980 and the rising number of automobiles as well as the rising fuel consumption in these years. For instance the number of passenger cars rose from 3.508 million cars in 1959 to 11.571 million in 1969, the CO emission rose from 3.012 million tons in 1959 to 3.647 million tons in 1969 and will further rise to 5.213 million tons by 1980. The oxides of nitrogen emissions rose from 310,500 tons in 1959 to 814,700 tons in 1969 and are expected to reach 1.22 million tons in 1980. What will be required of future development of technologies is the consideration of all aspects of environmental pollution from production, to consumption to disposal, the costs for which will be included in that of the products.

41202 **APTIC NO. 64352**

Herlan, Albert

POLYCYCLIC AROMATIC HYDROCARBONS IN THE AIR. QUANTITATIVE MASS-SPECTROMETRIC DETERMINATION. *(Polycyclische aromatische Kohlenwasserstoffe in der Luft). Text in German. Erdoel Kohle Erdgas Petrochem., 27(3):138-145, 1974. 37 refs.*

Two air samples taken at the Autobahn North of the exit Karlsruhe, Federal Republic of Germany, samples of dust sediments from an industrial area and a busy traffic artery in Mannheim and a residential area from Ulm as well as diesel fuels and light and heavy fuel oil were examined by high-resolution mass spectrometry at low-ionizing voltage. In the benzene extracts of the dust samples taken at the Autobahn 426 cyclic and polycyclic (z smaller than -6) types of hydrocarbons (maximum molecular weight 564), characterized by the formula CnH2n plus z, 43 with oxygen and 7 with sulfur were determined. The largest peak of the extracts consisted of compounds with z plus two to z minus four. Measurements in the gas chromatogram/mass spectrometer combination showed that the n-paraffins had by far the largest concentrations of a single group of compounds. At a comparison of the relative intensities of the mass spectra it was found that the three samples of dust sediments were very similar. In street dust a lower concentration of pure hydrocarbons and a higher quantity of O- and S-containing compounds was found. As with pure hydrocarbons the series z equalling minus 6 occurred most frequently among the compounds with one oxygen atom. Of these the C6H6O compounds assumed the largest concentration. The sulfur containing substances are very likely benzothiophenes (C8H6S), dibenzothiophenes and similar more condensated polycyclics as well as their alkyl derivatives with uni and di-valent C-atoms. From diesel oil and light fuel the concentrations of 10, from heavy fuel of 16 polycyclic types of compounds were determined. The groups with benzo-, di-, and tribenzopyrenes were among them. The contents of n-paraffins in the dust from the highway and of polycyclics in diesel oil emphasize that emissions of diesel engine are a very significant source of pollution.

41203 **APTIC NO. 65820**

Hiroyasu, Hiroyuki, Toshikazu Tsunoda, Shinji Ikura, and Yozo Yokoyama

SIMULATION FOR COMBUSTION AND EMISSION OF DIESEL ENGINE (2ND REPORT, HEAT GENERATION AND COMPOSITION OF EXHAUST GAS IN THE ENGINE). *Text in Japanese. Preprint, Japan Society of Mechanical Engineers, Tokyo, p. 63-66, 1974. 1 ref. (Presented at the Japan Society of Mechanical Engineers, National Meeting, Osaka, Japan, Nov. 3-5, 1974, Paper 1412.)*

Extending the previously reported simulation of diesel engine and exhaust to an actual engine, studies were made of the heat generation in a combustion chamber with variable volume by piston and the combustion room internal pressure. The combustion temperature of each element in the jet spray was calculated and the concentration of nitric oxide in the exhaust gas was calculated from the theoretical reaction speed of the NO formation process. The concentration of other components were obtained from the theory of equilibrium. The pressure curve and the concentration of combustion gases were predicted and satisfactory results were obtained.

41204 **APTIC NO. 64416**

Horino, Seiya

COMBUSTION OF A BOILER FREE FROM PUBLIC NUISANCE. *(Boira no mukogai nensho). Text in Japanese. Boira Gishi (Boilermen), 29(4):302-315, April 1974.*

The current emissions standards, and control methods, for boilers are summarized. Pollution consists of coke, soot, sulfur dioxide, and nitrogen dioxide. Coke is made up of small particles of residual carbon of 10 to 100 micron, and soot is a substance made of carbon gasified by evaporation or thermal disintegration. The volume of coke and soot is affected by droplet size, volume of residual carbon, oxygen partial pressure, combined diffusion of fuel and oxygen, and reaction time. Countermeasures for pollution material were adopted according to laws and ordinances which came into effect in June, 1971. Two methods decrease the concentration of SO2 in exhaust gas. One is designed to decrease sulfur content in fuel preceding combustion, while the other is designed for desulfurization after the combustion stage. The basic principle of measures against NOx is to decrease NOx by changing the factors to affect occurrence of NOx. Methods such as off-set firing, exhaust gas recycling, and a method of employing the above-mentioned two methods at the same time are being adopted.

41205 **APTIC NO. 63980**

Kirkpatrick, Lane W.

AIR POLLUTION ASPECTS OF PROPOSED OIL SHALE DEVELOPMENT IN NORTHWESTERN COLORADO. *Quart. Colo. Sch. Mines, 69(2):103-108, April 1974.*

Expected emissions from oil shale processes, carcinogens in oil shale, and effects of oil shale development of ambient air quality are discussed. The TOSCO-type oil shale process produces 25 gal of oil/ton of shale process. A proposed plant containing six retort furnaces would produce fugitive dust emissions from mining operations and crushing; particulates, sulfur oxides, nitrogen dioxide, hydrocarbons, and carbon monoxide from the retort, gas and oil recovery processes, and the boilers; and hydrocarbons from the oil storage. Control methods include wetting fugitive dust, baghouses for dust, and water sprayers for gaseous emissions. The total emission rates in lbs/hr would be 110 sulfur dioxide, 6500 NOx, 830 particulates, 310 hydrocarbons, and 59 CO. The amounts of carcinogens such as kerogen, polycondensed aromatic compounds, and polynuclear aromatic hydrocarbons produced by oil shale are being studied. Because of the large amounts of particulate matter and sulfur oxides produced by oil shale processes, it is questionable whether such processes can meet emission standards. Air pollution predictive models should be used to determine the effects of oil shale processes on ambient air quality to see if standards could be weakened to meet increased energy needs.

41206 **APTIC NO. 63704**

Kooij, J. van der and A. J. Elshout

THE EMISSION OF NITROGEN OXIDES BY POWER STATIONS. *Ingenieursblad, 43(10):311-317, 1974. 15 refs.*

Results of investigations concerning nitrogen oxides emissions from power stations are reported and discussed. When fuel is burned in air, oxides of nitrogen are formed partly by the combination of atmospheric nitrogen and oxygen at high temperatures and partly by the oxidation of organically bound nitrogen in the fuel. The major factors affecting the formation of nitrogen oxides in combustion processes, are combustion temperature, availability of combustion air, mixing of fuel, air, and combustion products, heat release and removal, and fuel type. Nitrogen oxide emissions (inventories) by Dutch power stations are low compared to American emissions. Gas firing in very large units may result in a very high NOx emission. During a field study a relationship was noted between emission and unit size; there was a stronger increase of the emission with horizontal than with tangential burner position. The favorable effect of the latter type of firing is particularly attributed to the way in which fuel and air are admitted. The entire furnace assumes the function of a burner, which results in a more even temperature distribution. A similar more even temperature distribution in the future, or at any rate a decrease of the peak temperature, can, with a horizontal burner position, be obtained by recirculation in the burner zone or by two-stage combustion. The latter method, combined with low excess air firing has been studied by a number of Dutch units, and considerable decreases of the emissions have been established.

41207 **APTIC NO. 63965**

Laemmel, Peter

WHERE DOES SULFHUR DIOXIDE ACTUALLY COME FROM? *(Wo kommt das Schwefeldioxid tatsaechlich her)? Text in German. Umwelt (Duesseldorf), 4(Spec. issue):21-30, June 1974. 5 refs.*

Compilation of sulfur dioxide emission inventory for the Federal Republic of Germany required the division of sources into 14 production sectors. From this analysis some characteristic changes of SO2 pollution during the past become apparent. For instance in 1972 roughly 44% of the total SO2 emission was caused by the power generation and mining sectors, whereas in 1960 it was only 34%. A matrix of interrelations of SO2 emissions from production and final consumer sectors as measured in 1966 is presented. The final demand for electrotechnical products and products of the iron, sheet steel, and metal industry lead in 1966 to an emission of more than 163,000 tons of SO2 of which only 18,000 tons of SO2 were emitted by the electrotechnical, iron, sheet steel, and metal industries themselves. By far the major portion has been emitted by the manufacture of the basic products used by these industries.

41208 **APTIC NO. 63792**

Lange, Howard B., Jr., Daniel P. Pierce, and John W. Kisner

EMISSIONS FROM A KRAFT RECOVERY BOILER-THE EFFECTS OF OPERATIONAL VARIABLES. *TAPPI, 57(7):105-109, July 1974. (Presented at the Technical Association of the Pulp and Paper Industry Alkaline Pulping Conference, Atlanta, Ga., Oct. 22-24, 1973.)*

Tests were run on a recovery boiler operating at relatively high green liquor sulfidity to determine the influence of key operating variables on emissions of sulfur dioxide and particulates. Observed trends are compared to similar trends predicted by a computer model of the furnace. The test results are first interpreted in a qualitative sense in terms of the major operational variables varied during testing. Test data showed qualitative agreement with the model in its predictions that increasing the S/Na2 (sulfur/sodium) ratio in the black liquor increases SO2 emissions and decreases particulate emissions and, increasing primary air (as a fraction of theoretical) decreases SO2 emissions and increases particulate emissions. However, significant variations in SO2 emissions were not accounted for by the model. These unaccountable changes appear to be due to changes in black liquor properties, which were not closely monitored during the tests. More complete monitoring of liquor composition and physical properties are needed.

41209 **APTIC NO. 63656**

Luecke, R., M. Schwarz, and E. Lipp

PROCESSING OF MOULDED MATERIALS FEATURING GREAT FIBER PORTIONS. *(Aufbereitung von Pressmassen nit hohen Faseranteilen). Text in German. Aufbereitungs Technik, 15(6):291-296, 1974.*

Mixing and drying of insulation friction-lining and It materials requires highly efficient production machinery because of the heterogeneous structure of these materials. Vacuum drying is of advantage for moulded masses if they contain relatively small quantities of binding agent dissolved in organic solvents. The vapors can be easily condensed because of the small inert gas fraction. The environmental pollution is low because during drying only the small quantity of air leaking out carries non-condensable solvents into the atmosphere. In the aeration dryer the vapors too are condensed. Environmental pollution by solvents is low. The losses within the dryer amount of 3% at the most. Filters and cyclones must be a bit larger than for vacuum dryers.

41210 **APTIC NO. 64147**

Mandels, M., J. Nystrom, and L. A. Spano

ENZYMATIC HYDROLYSIS OF CELLULOSIC WASTES. *Preprint, American Defense Preparedness Assoc., 19p., 1974. 16 refs. (Presented at the American Defense Preparedness Association Annual Symposium on Environmental Research, 5th Annual, Washington, D. C., March 13- 14, 1974.)*

The use of enzymatic hydrolysis of cellulosic wastes for generation of fuel, glucose, solvents, and chemical feed stocks is reviewed. Cellulose is broken down by enzyme hydrolysis to glucose which in turn can be fermented to give such products as fuel (ethanol), solvents (acetone), antibiotics, and enzymes. Chemical conversion of glucose can be used to generate chemical raw materials. Ethanol-gasoline fuel blends could be used to power automobiles and other internal combustion engine driven devices in order to extend petroleum reserves. Enzymatic hydrolysis of cellulose to glucose is estimated to be technically feasible and practically achievable on a very large scale by the year 1980.

41211 **APTIC NO. 63985**

Matsui, Masataka, Shigeru Takahashi, and Kimio Tanaka

URBAN TRAFFIC PROBLEMS VIEWED FROM ENERGY AND ENVIRONMENT. *(Enerugi to kankyo-men kara mita toshi kotsu no shomondai). Text in Japanese. Nihon Kikai Gakkai-shi (J. Japan Soc. Mech. Engrs.), 77(663):219-224, Feb. 1974. 9 refs.*

The main problem in urban traffic is air pollution caused by automobiles and trains. The transportation situation is becoming worse because although the population has moved away from the central cities, the working places remain there. Since 10-15% of the total energy used in Japan is for transportation, development of efficient means of mass transportation is necessary. The mass tranportation vehicle consumes less energy per person than the automobile when driven with a full load, but there is a great deal of inefficiency due to their operation with less than a full load. Although various types of motor vehicles will be developed in the near future, efficiency of energy consumption will not change much. A more effective way to decrease energy losses would be the development of a system to decrease the frequency of stops in driving. Acceleration and stopping accounts for 50% of all energy used in driving. Since 90% of carbon monoxide, 50% of hydrocarbons, and 40% of nitrogen oxides emitted in the Tokyo area come from motor vehicles, pollution control of motor vehicles is vital in this area. Various types of engines with lower pollutant emission are under development, but these will contribute to the energy problem because they consume more gasoline per unit distance than present engines. This points out the fundamental inconsistency between cleaning the environment and decreasing energy consumption. This will have to be solved by a decrease in the number of cars and the development of alternative transportation systems.

41212 **APTIC NO. 65789**

Nielsen, H.

ISOTOPIC COMPOSITION OF THE MAJOR CONTRIBUTORS TO ATMOSPHERIC SULFUR. *Tellus (Uppsala), 26(1-2):213-221, 1974. 12 refs.*

The delta-34 sulfur patterns of the major suppliers of atmospheric S are discussed. Their delta ranges overlap so completely that S isotope data of atmospheric samples cannot be used to calculate the net contribution rates from the individual sources at a global scale. For selected areas such conclusions can frequently be drawn. The most reliable results are from areas with only two (at maximum three) major S suppliers with well known S isotopic composition and large delta difference between the individual sources. Limitations are mainly due to the complex origin of atmospheric S from a variety of different sources (especially in highly industrial regions) and by the broad delta ranges even in relatively uniform suppliers. The fate of the S compounds after emission to the atmosphere may be complex. Additional fractionation processes efface the fingerprint character of the S isotope composition. These difficulties can sometimes be overcome when the S isotope values are correlated with other geochemical data. (Author abstract modified)

41213 **APTIC NO. 63899**

Odaira, Toshio, Tatsukichi Ishiguro, Yoshiteru Iwasaki, Hiroshi Fukushima, and Shunkichi Onozuka

INVESTIGATION AND STUDIES ON PHOTOCHEMICAL SMOG EMISSION SOURCES. (FIXED SOURCES) GENERAL CONDITION OF FIXED SOURCES. *(Kokagaku sumoggu hasseigen ni kansuru chosa kenkyu. (Kotei hasseigen) Kotei hasseigen no gaikyo). Text in Japanese. In: Studies on Tokyo Smog. Tokyo Metropolitan Research Inst. for Environmental Protection (Japan), Rept. 3, p. 185-190, March 1974.*

The fixed emission sources of nitrogen oxides are mostly electric power plants, boilers in various industries, refuse incinerators, and industries using nitric acid such as the case of surface treatment process of metals. The fixed sources of hydrocarbon emissions are industries related to the painting, printing, and adhesive agents. The smoke emission sources in Tokyo metropolitan area are about 12,000. The data on NOx and HC emission in 1972 were compiled, and the emission quantity classified by the type of industry and the contributory rate were determined. The estimated total emission quantity of NOx and HC are 29,906 tons/year and 72,220 tons/year, and the contributory rates are 31% and 33%, respectively.

41214 **APTIC NO. 63579**

Panzer, J.

IDLE EMISSIONS TESTING--PART II. *Preprint, Society of Automotive Engineers, Inc., New York, 14p., 1974. 24 refs. (Presented at the Society of Automotive Engineers Automotive Engineering Congress, Detroit, Mich., Feb. 25-March 1, 1974, Paper 741033.)*

The relative merits of procedures using idle and short loaded emission tests to reduce vehicle exhaust emissions were evaluated using data from two test fleets. The incidence of engine malfunctions and the effect of each on idle emissions were used to develop a diagnostic procedure based on non-loaded testing (idle and 2500 rpm emissions). Tune-up repairs beyond those indicated by the procedure produced no significant further emissions reduction. Non-loaded emissions testing combined with the non-loaded test diagnostic procedure can be as effective as loaded testing combined with a loaded test diagnostic procedure in reducing emissions both at idle and under load. The non-loaded test diagnostic procedure more correctly identified the malfunctions responsible for cars failing the emissions test than did the loaded test procedures. This involved carburetor replacements that did not have to be made for cars to pass idle and loaded emissions tests. These replacement reduce emissions. Idle adjustments only (air-fuel mixture, idle speed, basic timing) were capable of repairing 55% of the rejected test cars so that they would pass emission tests. Further repair produced no significant additional emissions reduction. (Author abstract modified)

41215 **APTIC NO. 63959**

Parker, Albert

COMPARISON OF AIR POLLUTION STATISTICS. *Clean Air, 4(14):24-26, Summer 1974.*

Data is presented from statistics on the coal equivalents of the primary forms of energy used in the United Kingdom in 1938, 1956, and each year from 1960 to 1972. The primary forms of energy are coal, oil, hydro electricity, nuclear electricity, and natural gas. Quantities of coal used in domestic, coal mine railway, power station, and industrial miscellaneous and colliery grates or furnaces that may cause smoke emission in the U. K. in these years are also given. Estimates are given of air pollution by smoke and oxides of sulfur from the uses of coal, coke, and oil in the U. K. in each year.

41216 **APTIC NO. 63548**

Pervier, J. W., R. C. Barley, D. E. Field, B. M. Friedman, R. B. Morris, and W. A. Schwartz

SURVEY REPORTS ON ATMOSPHERIC EMISSIONS FROM THE PETROCHEMICAL INDUSTRY. VOLUME III (FINAL REPORT). *Air Products and Chemicals, Inc., Marcus Hook, Pa., Houdry Div., Environmental Protection Agency Contract 68-02-0255, Rept. EPA-450/3-73-005-c, 259p., April 1974.*

One of a series of four survey reports on atmospheric emissions from the petrochemical industry is presented to assist the Environmental Protection Agency in determining the significance of such pollutants. The present volume covers the following processes: maleic anhydride, nylon 6, nylon 66, oxo processes, phenol, high-density polyethylene, and low-density polyethylene. The report includes a process description, a process emission inventory, a catalog of emission control equipment, a list of producers, and an evaluation of the significance of the air pollution from each process. A summary table of emissions to the atmosphere from all of the processes studied is also included.

41217 **APTIC NO. 63859**

Ruedinger, Volker

A MODEL OF DEPOSIT FORMATION ON DIESEL ENGINE PISTONS. *(Ein Modell der Ablagergerungsbildung am Dieselmotorkolben). Text in German. Erdoel Kohl - Erdgas - Petrochem., 27(7):353-358, July 1974. 78 refs.*

A relationship between exhaust gas turbidity and pollution of the lubricating oil was confirmed with a test diesel engine. The higher the exhaust gas turbidity was in a test cycle the greater was the pollution of the lubricating oil. Soot reducing fuel additives also reduce the amount of deposits. Combustion of diesel fuel may be incomplete even at high air surplus so that soot is produced. Through condensation of C2 and C3 and aromatic fragments soot crystals of 100 to 500 A form which agglomerate to particles of 0.05 to several micron. With increasing load the air surplus is reduced and soot formation becomes more intease. Depending on the combustion process, between 500 and 3000 ppm oxides of nitrogen are formed at full load.

41218 **APTIC NO. 63744**

Sawada, Teruo, Ryo Nishi, and Akio Danjo

STUDIES ON POLLUTANTS EMITTED BY GAS TURBINES AND CONTROL METHODS. PART 3: EXHAUST GASES IN TRANSIENT STATE. *(Gasu tabin yori haishutsu sareru osen busshitsu to sono togyoni kansure kenkyu. Daisanpo Kato jotai no haigasu chosa). Text in Japanese. Preprint, Japan Society of Mechanical Engineers, p. 97-100, May 1974. 4 refs. (Presented at the Japan Society of Mechanical Engineers Meeting, 841st, Tokyo, Japan, May 1974, Paper 14.)*

The acceleration and deceleration characteristics of the compressor operating curve in the range of 20,000 to 35,000 rpm were examined. At rapid acceleration, the characteristic curve showed a bend in the vicinity of the upper limit of the rotational frequency. During slow acceleration and deceleration, the characteristic curves were analogous to those of the stationary state. The pressure, temperature, flow rate, and rotational frequency were all automatically recorded. Using kerosene as fuel, the concentration of carbon monoxide, total hydrocarbons, and nitrogen oxides were measured. In the transient state of the gas turbine, the emission concentrations of pollutants were approximately same as those of the stationary state. At acceleration, the NOx concentration increased, which corresponded to the variation in fuel-air ratio. The CO concentration rapidly decreased, though a time delay attributable to the heat capacity in the passage area and turbine was observed. The THC concentration decreased simultaneously with the increase in NOx; however, the decreasing trend was inconsistent with that of fuel-air ratio, which was attributable to the variation in THC composition by unknown causes. At the deceleration, the CO and THC concentrations increased rapidly, while the NOx concentration decreased contrary to the case of acceleration.

41219 **APTIC NO. 63988**

Spengler, Guenter, Knut Maier, Rudolf Woerle, and Michael Schiewer

GAS CHROMATOGRAPHIC SEPARATION OF COMPONENTS OF HC EMISSION FROM OTTO ENGINES AND THEIR IDENTIFICATION. *(Gaschromatographische Trennung von Einzelkomponenten der CH-Emission von Ottomotoren und ihre Identifizierung). Text in German. Erdoel Kohle-Erdgas-Petrochem., 27(5):246-251, May 1974. 10 refs.*

A brief review of complexity and methodology of separation of hydrocarbon emission from Otto engines by gas chromatography and identification of separated hydrocarbons is given. In addition, gas chromatographic studies of HC emission from a stationary operated single cylinder test engine using both commercial fuels and pure hydrocarbons are reported. In the combustion of isooctane and isooctene, methane and ethane are formed in clearly higher quantities than in the combustion of cyclohexane, methylcyclohexane and toluene. Particularly low methane and ethane fractions were observed in toluene combustion. Unsaturated C2 hydrocarbons develop in relatively high percentages in the combustion of cyclohexane and methylcyclohexane. High amounts of C4 olefins were determined in the emissions stemming from the combustion of isooctane and isooctene. A comparison of the percentage fraction of unburned hydrocarbon shows a decrease in the sequence toluene, methylcyclohexane, cyclohexane, isooctane, isooctene The hydrocarbon emissions from combustion of premium gasoline contained apart from the characteristic aromatic main components, C4 olefins, n-butane/1-3 butadiene, iso-pentane, n-pentane as well as methylated pentanes and pentenes in the boiling range between methane and benzene and 2 and 3-methylhexane as well as n-heptane and C7 monoolefins within the boiling range of benzene and toluene.

41220 **APTIC NO. 66062**

Stern, Helman I., Patrick A. Petrella, Jr., and Elmar R. Altwicker

MODELING TOTAL VEHICLE EMISSIONS ON A REGIONAL LEVEL. *J. Environ. Syst., 4(1):65-80, Spring 1974. 11 refs.*

A dynamic mathematical model is presented for the projection of total annual emissions of hydrocarbons, carbon monoxide, and nitrogen oxides from mobile sources in urban regions. The model consists of three subsystems: vehicle population, vehicle activity, and vehicle emission rates. Application of the model through the use of four separate vehicle emission compliance schedules to the Albany-Schenectady-Troy Standard Metropolitan Statistical Area (SMSA) based on 1964-1970 data results in emission projections for the period 1971-1990 which are shown in graphical form. (Author abstract modified)

41221 **APTIC NO. 64405**

Tomcsanyi, Gabor

OPERATING EXPERIENCES WITH AIR-COOLED CONDENSATION PLANTS SYSTEM HELLER AND DEVELOPMENT TRENDS CONCERNING AIR-COOLING IN LARGE POWER PLANTS. *(Betriebserfahrungen mit luftgekuehlten Kondensationsanlagen System Heller und Entwicklungstendenzen der Luftkuehlung bei Grosskraftwerken). Text in German. Energietechnik, 24(5):214-219, May 1974.*

Because of the increasing shortage of water a new cooling system called the Heller indirect air cooling system is becoming popular. The system has the advantage of avoiding any emission of steam plumes which may lead to fog and ice formation in the vicinity. In addition air warms up in a dry cooling tower to about 20 C which in winter prevents fog and smog and has a ventilating effect in the neighborhood. The Heller air cooling systems in operation and those under construction are listed. Measurements of the cooling capacity are discussed as well as the influence of the wind on the cooling capacity. In the future, a combination of dry cooling in winter with wet cooling in summer will be increasingly used because it avoids the relatively unfavorable condensator vacuum of dry cooling in summer due to the higher ambient temperatures.

41222 **APTIC NO. 64328**

Trenkler, Harro

ENVIRONMENTALLY HARMLESS USE OF PRIMARY ENERGIES - A TASK OF THE ELECTRICITY GENERATION INDUSTRY. *(Umweltfreundliche Nutzung der Primaerenergien - eine Aufgabe der Elektrizitaetswirtschaft). Text in German. Elektrizitaetswirtschaft, 73(11):287-293, May 1974. 18 refs.*

The environmental impacts of electricity generation and the environmental advantages of the use of electricity are surveyed. A statistical survey for the year 1970 shows that the share of electricity generation in the total primary energy consumption amounts to about 25%, while its share in the pollutant emission amounts to only 9%, which low specific emission is due to the optimized combustion conditions and to the use of improved dust separation and flue gas cleaning equipment in power plants. Assuming a stabilization of the oil consumption by power plants after 1975, the share of thermal power plants in the sulfur dioxide emission in 1980 will be 16% against 13% in 1970. The increasing replacement of solid fuels by liquid and gaseous fuels in power plants will result in a decrease in the power plant emissions despite stepped-up electricity generation. The total energy needs can be reduced by the coupling of electricity generation with heating systems, possibly via heat storage units.

41223 **APTIC NO. 63752**

Volsicky, Zdenek

POSSIBILITIES OF REDUCING THE BROWN COAL SULFUR CONTENT BY MECHANICAL MEANS IN THE NORTH BOHEMIAN LIGNITE MINES. *(Moznosti snizovani sirnatosti hnedeho uhli severoceskeho hnedouhelneho reviru mechanickou upravou). Text in Czech. Uhli, 22(2):67-69, 1974. [illegible] refs.*

Oxidation of brown coal samples was done for 2 min in an electric furnace at 200-600 C, at high-frequency heating (27 Mc, 180 W) for 2 min, with super-heated steam (400 C) for 1 min, and with air oxidation in a 25 kV arc discharge for 1 min. This was followed by magnetic separation (at 10,000 Oersted). The highest degree of separation less than 94%) was obtained by the first method at 600 C, with particle sizes below 0.5 mm. However, the residual coal still contained up to 7.3% S because the fine particle-sized pyrite was intimately mixed with the coal particles. Separation was attempted by classifying and then floating the coal dust. Only a dust of particle size below 25 micron produced a significantly decreased S content. Since grinding to such fine particle sizes is not economical, the problem is no nearer solution.

41224 **APTIC NO. 63446**

Wallin, Thomas

DEPOSITION OF AIR-BORNE MERCURY AROUND SWEDISH CHLOR-ALKALI PLANTS SURVEYED BY ANALYSES OF SNOW AND MOSS. *Inst. for Vatten- och Luftvardsforskning, Goteborg (Sweden), Rept. B-191, 18p., April 1974. 11 refs.*

The local deposition of airborne mercury around a number of chlor-alkali plants situated in the middle and the northern parts of Sweden was surveyed by analyses of Hg in snow samples collected within a radius about 5 km around each plant and analyses of Hg in the carpet-forming moss, Hypnum cupressiforme, within 15 km of the plants. Neutron activation analyses were used in the Hg analyses. The highest Hg concentrations in snow and moss were found close to the plants and decreased rapidly with increased distance from the emission source within the first kilometers. At an average distance of 3-6 and 9-15 km, the Hg concentrations in snow and moss, respectively, were usually not significantly higher than the estimated background levels (approximately 0.1 ng/g in snow and approximately 120 ng/g in moss). Annual fallout estimates indicated that only a minor part of the emitted mercury (less than or equal to 10%) was deposited locally. The major part spread over very large areas and contributed to the background deposition and probably to the global circulation. (Author abstract modified)

41225 **APTIC NO. 63888**

Watanabe, Takeharu

A SURVEY OF MOBILE EMISSION SOURCES. *(Ido hasseigen no gaiyo). Text in Japanese. In: Studies on Tokyo Smog. Tokyo Metropolitan Research Inst. for En-*

vironmental Protection (Japan), Rept. 3, p. 111-123, March 1974. 4 refs.

Mobile pollutant emission sources are reviewed. The total automobile holdings in Japan, the transition in automobile production over the years, the number of automobile owners in Tokyo, the road conditions, the traffic conditions, fuel sales, and emission gases are discussed. The ratio of automobiles per given space has increased phenomenally over the last 15 years in Japan, increasing the problem of pollution. Already in 1969, the ratio of automobiles per 1000 hectare of land was about 10 times over that of the United States, and the number continues to grow. The growth rate of automobile production has been 10-15%/yr for many years. In 1972, the total number of automobiles in Tokyo was 10.6% of the total number of cars in Japan, increasing 6.1% over the number in the previous year. The total daily average of traffic tie-up (excluding holidays and Sundays) for 1972 (tie-up distances 180-360 m) was 783 hours, which was an increase of 18.3% over 662 hours in 1971, and 300% over 1965. According to the investigation of the Tokyo Metropolitan Bureau of Pollution Control, the ratio of mobile sources contribution to the total pollution is: aldehydes, 87%, nitrogen oxides, 69%, hydrocarbons, 67.1%, and carbon monoxide, 94.6%, showing that automobiles are the main source of these harmful gases. The mobile sources contributory ratio for sulfur dioxide is 4.4%, and for dusts, 4.5%.

41226 **APTIC NO. 64392**

Witzky, Julius E.

A GAS ENGINE WITH STRATIFIED LAYER CHARGING. *(Ein schicht geladener Gasmotor). Text in German. Motortech. Z. (Stuttgart), 35(8):251-254, 1974. 3 refs.*

The gas engine with stratified layer charge is simple in construction and maintenance. The air is unchecked, thus the engine operates over the largest part of the load range with surplus air which leads to a better combustion and a lower exhaust gas temperature. The dangerous advance ignition observed frequently with ordinary gas engines is avoided because an ignitable mixture exists only in the vicinity of the ignition source. The construction of a test engine with quartz window so that the combustion processes could be studied was of great help in the development of the gas engine.

41227 **APTIC NO. 63747**

Yoshida, Koichi, Noriyuki Koike, Yujiro Tsukamoto, and Kenichi Ogura

ON THE STUDIES FOR DIESEL EXHAUST EMISSIONS (1ST REPORT)-- CHARACTERISTICS OF DIESEL EXHAUST EMISSIONS UNDER STEADY STATE AND TRANSIENT CONDITIONS. *(Dizeru haiki gasu no sokutei (daiippo) teijo oyobi kasoku gensokuji no tokusei). Text in Japanese. Kotsu Anzen Kogai Kenkyusho Hokoku (Res. Inst., Traffic Safety Environ. Prot. Rep.), no. 2:29-37, March 1974. 2 refs.*

Diesel exhaust emission, in general, has been measured under steady state on an engine dynamometer. An emission test was performed on a chassis dynamometer to analyze transient conditions in addition to steady state conditions. Ten diesel-powered trucks were selected as test vehicles. Emission data on carbon monoxide, hydrocarbons, oxides of nitrogen, and smoke were obtained. The Federal 13-mode cycle and tentative D-7-mode cycle were applied as evaluating procedures, and mass emission and average exhaust concentration were analyzed comparatively. Mass emission data over the 13-mode cycle was similar to that published by the CARB. Correlation between mass emission and average exhaust concentration over the D-7-mode cycle was almost linear. Acceleration and deceleration tests were performed at several vehicle speed ranges and at two acceleration grades (0.04 and 0.06 g). For diesel smoke tests, free acceleration and wide open throttle acceleration from 10 km/hr cruising were applied; the measured data were compared with test results under steady state at full load.

41228 **APTIC NO. 63748**

Yoshida, Koichi, Noriyuki Koike, Yujiro Tsukamoto, and Kenichi Ogura

MEASUREMENT OF DIESEL EXHAUST EMISSIONS (2ND REPORT)--ANALYSIS OF EXHAUST MASS EMISSIONS AND EMISSION FACTORS OVER TEST DRIVING CYCLES. *(Dizeru haiki gasu no sokutei (dai2ho) soko saikuru ni yoru haishutsu juryo haishutsu keisu to no sokutei). Text in Japanese. Kotsu Anzen Kogai Kenkyusho Hokoku (Res. Inst. Traffic Safety Environ. Prot. Rep.), no. 2:39-47, March 1974. 8 refs.*

Exhaust emission data from ten diesel powered trucks are described. The engines are three 4-cycle, direct-injection engines, four 4-cycle, precombustion-chamber engines, and three 4-cycle, swirl chamber engines. Emission tests were performed on chassis dynamometers under four kinds of test driving cycles which have different average vehicle speeds. Test data on carbon monoxide, hydrocarbon, oxides of nitrogen, and smoke are given and analyzed to give average concentration, mass emission, and emission factor. The lowest average concentration was obtained with a precombustion-chamber engine. The average concentrations of CO and HC for direct-injection and swirl chamber engines were about the same. The oxides of nitrogen concentrations from direct-injection engines were highest in all test engines. Mass emission in g/km tended to decrease with the increase of average vehicle speed. The emission factor in g/fuel-1 and mass emission in g/ton-km were relative to average exhaust concentrations linearly.

41229 **APTIC NO. 63889**

Yoshizumi, Kunio, Koichi Inoue, Tasuo Iida, and Toshio Odaira

AUTOMOBILE OPERATION AND EXHAUST GAS COMPOSITIONS. *(Soko jotai to haiki gasu sosei). Text in Japanese. In: Studies on Tokyo Smog. Tokyo Metropolitan Research Inst. for Environmental Protection (Japan), Rept. 3, p. 124-127, March 1974. 4 refs.*

Automobile emissions were tested on a dynamometer using a 4-cycle 4-cylinder domestic engine with a 1600 cc capacity, using regular gasoline. The composition of exhaust gases was measured by the direct method and the CVS (contant volume sampler) weight method, and the relationship between the speed, acceleration, and concentration of pollutants were studied. Previously, the Tokyo Metropolitan Research Inst. for Environmental Protection had advocated the 8-mode operation based on the measurements taken during actual driving. But by this experiment, it became clear that all pollutants concentrations were higher for the 8-mode operation than for 4-mode or 10-mode operation. This is probably due to the greater ratio of acceleration required for 8-mode driving. There is a notable increase of nitrogen oxides with increase of speed. On the other hand, carbon monoxide and hydrocarbon emissions increase with low speed driving of 20 km/hr, due to the unstable engine condition in the second gear. However, CO increases at 60-80 km/hr also. When the final speed was set at 40 km/hr, and acceleration was varied to reach that speed, the ratio of CO and hydrocarbon emissions increased with increasing acceleration rate and the NOx emission decreased. This is due to the strong effect of the air-fuel ratio.

41230 **APTIC NO. 63890**

Yoshizumi, Kunio, Koichi Inoue, and Toshio Hamano

ALDEHYDES IN AUTOMOTIVE EXHAUST GASES. *(Jidosha haiki gasuchu no arudehidorui). Text in Japanese. In: Studies on Tokyo Smog. Tokyo Metropolitan Research Inst. for Environmental Protection (Japan), Rept. 3, p. 128-131, March 1974. 8 refs.*

Qualitative and quantitative studies of aldehydes in automobile exhaust gases were made. The relationship between the composition of aldehydes in exhaust gas and fuel and also driving conditions was clarified and the aldehyde characteristics of rotary engine cars were examined. Two engines were examined:

one 4-cycle, 4-cylinder domestic car of 1600 cc capacity reciprocating engine, and a domestic rotary engine with two rotors without thermal reactor. Five types of fuel were used, and exhaust gases were sampled on a chassis dynamometer during idling and during a 40 km/hr driving. To unify the conditions, each fuel was adjusted so that carbon monoxide concentration at idling would be about 5%. Samplings were taken by a heated copper pipe connected with the exhaust pipe, and gas chromatography was applied. In all cases, the concentration of aldehydes was several times higher when operating at 40 km/hr than when idling. Formaldehyde existed in all types of fuel in high concentrations. When isooctane and n-heptane fuel was used, benzaldehyde was not detected; when toluene fuel was used, a high concentration of benzaldehyde was detected. A mixture of regular gas plus 20% methanol increased all types of aldehydes. With the rotary engine, all elements were four times greater than the reciprocating engine during idling, and two times greater with 40 km/hr driving. All aldehydes were equally higher in the rotary engine. The greater surface area of the combustion chamber may account for this.

41231 **APTIC NO. 63661**

Zhukov, V. I., T. N. Livke, P. K. Zaika, I. I. Voldayeva, and M. V. Gavrilyuk

WAYS OF ABATING GASEOUS AND PARTICULATE POLLUTANT CONCENTRATIONS IN THE AIR IN THE CHEMICAL INDUSTRY. *(Puti snizheniya zagazovannosti i zapylennosti vozdukha na predpriyatiyakh khimicheskoy promyshlennosti). Text in Russian. Khim. Prom. (Moscow), no. 5:371-372, 1974.*

Results of workplace pollutant concentration measurements in chemical plants, and measures planned or taken for emission abatement in such plants are described. The sulfur dioxide, dust, and nitrogen dioxide concentrations measured in a sulfuric acid production plant were in excess of the maximum allowable concentrations in 8.5%, 7.2%, and 37.7% of all cases, respectively. The hydrogen phosphide, dust, hydrofluoric acid concentrations in a phosphate fertilizer plant exceeded the limit values in up to 70% of all cases. An epidemiological survey conducted among the workers revealed that pneumonia was responsible for 30% of all diseases, while the respective shares of the diseases of the upper respiratory tract, of bronchitis, and gastrointestinal affections were 27%, 2%, and 5%, figures that are indicative of the predominant influence of dust. Wet method and closed cycle operation in a phosphate processing plant, the use of centrifugal scrubbers in a superphosphate manufacturing plant, and alkaline adsorption of phosphates for the reduction of the fluoride emissions, as well as ozone-catalytic purification and the use of fibrous filters for the reduction of the SO2, sulfur trioxide, and sulfuric acid production plant are among the principal measures taken so far for pollution abatement.

41232 **APTIC NO. 63585**

Office of Air and Water Programs, Research Triangle Park, N. C., Air Pollution Technical Information Center

AIR POLLUTION ASPECTS OF EMISSION SOURCES: COKE OVENS. A BIBLIOGRAPHY WITH ABSTRACTS. *Pub-EPA-450/1-74-002, 60p., March 1974. 235 refs.*

NTIS: PB 232498/AS

Abstracts are given of available literature pertinent to emission sources associated with coke ovens, the effects of those emissions on man and his environment, and the feasible technology for their control. Methods for measuring effluents, air quality measurements near coke plants, standards and criteria and legal and administrative aspects, and effects of the emissions on humans, plants, animals, and materials are included.

41233 **APTIC NO. 63586**

Office of Air and Water Programs, Research Triangle Park, N. C., Air Pollution Technical Information Center

AIR POLLUTION ASPECTS OF EMISSION SOURCES: SURFACE COATINGS -- THEIR PRODUCTION AND USE. A BIBLIOGRAPHY WITH ABSTRACTS. *Pub-EPA-450/1-74-005, 74p., March 1974. 235 refs.*

NTIS: PB 232501/AS

Abstracts are given of available literature pertinent to the emissions associated with the manufacture of surface coatings, the effects of those emissions on man and his environment, and feasible technology for their control. Main subjects included are emission sources, control methods, air pollutant measurement method, air quality measurements, atmospheric interactions, basic science and technology, standards and criteria, legal and administrative aspects, social aspects, and effects of emissions on human health, animals, materials, and economics.

41234 **APTIC NO. 64139**

Ford Foundation Energy Policy Project, Washington, D. C.

EXPLORING ENERGY CHOICES, A PRELIMINARY REPORT. *87p., 1974. 94 refs.*

The effects of air pollution and air quality goals on energy alternatives are discussed. Damage from air pollution dropped from $16.1 billion in 1968 due to the increased use of air pollution controls and to the switch by power plants from coal to fuel oil and natural gas. There are strong pressures to delay putting air quality goals into full effect even though there is no clear margin of safety for any pollutants above the legal standard. In 1968 there was $4 billion of damage caused by sulfur dioxide from power plants, but sulfur oxides controls would have cost only $3 billion including fixed charges and operation costs. Metallic particles in the air caused by burning fossil fuels can interact with SO2 and form the more hazardous sulfuric acid and sulfates. There particles also tend to worsen the impact of other pollutants. Catalytic converters are reducing automotive air pollutants in the form of hydrocarbons, carbon monoxide, and nitrogen oxides. Automobiles equipped with the converters emit sulfate particles through reactions in the converter with sulfur in the fuel. The emissions are not large, but they are in urban areas and may present adverse health effects in 2-3 yr. Energy consumption and fuel supplies are discussed and suggestions are made for future energy policy.

41235 **APTIC NO. 64179**

Dept. of Land, Forests, and Water Resources, Victoria (British Columbia), Pollution Control Board

REPORT ON POLLUTION CONTROL OBJECTIVES FOR THE CHEMICAL AND PETROLEUM INDUSTRIES. *63p., March 19, 1974.*

An inquiry was held to resolve the technical considerations and measures required of the chemical and petroleum industries of British Columbia to meet the requirements of the Pollution Control Act of 1967. Sampling and monitoring of waste discharges, waste management planning, in-plant control, and emergency and abnormal operating conditions are described. Air pollution control objectives are classified as Levels A, B, and C. Emissions and control from petroleum industries are described including general emissions from refineries, gaseous streams from petroleum industries, catalytic cracking regenerator and heater and power boiler stack emissions, storage tank hydrocarbon vapors, HC from air blowing of asphalts, flare stack emissions, and miscellaneous emissions. Emissions and control from natural gas plants discussed include general, main stack, flare, inlet separator, storage tank, and sulfur storage emissions. Emissions and control from oil and gas production discussed include general, battery site flaring, storage, and miscellaneous emissions. Emissions and control from oil and gas production discussed include general, battery site flaring, storage, and miscellaneous emissions. Emissions and control from the petrochemical industry discussed include general and gaseous emissions. Emissions and control in resin and paint industries discussed include general, formaldehyde, phenolic resin, urea-formaldehyde resin, polyester resin, alkyd resin, polyvinyl acetate emulsion, bodied oil production, and treated fiber product production emissions. Paint manufacture, chloralkali, and sodium chlorate industry emissions are discussed. Emissions from chlor-alkali processes utilizing mercury cells include mercury, chlorine, hydrogen chloride, particulates, and hydrogen sulfide. Gaseous emissions from chlor-alkali processes using diaphragm cells include lead. Gaseous emissions from sodium chlorate plants include chlorine, particulates, and hydrogen chloride. Emissions from sulfuric acid plants, alum plants, explosive plants, and fertilizer manufacturers are also discussed. Ambient air quality guidelines and monitoring programs are reviewed. Solid waste disposal and water pollution control guidelines and objectives are also discussed.

1973

41236 **APTIC NO. 63459**

Boccio, J. L., G. Weilerstein, and R. B. Edelman

A MATHEMATICAL MODEL FOR JET ENGINE COMBUSTOR POLLUTANT EMISSIONS. *General Applied Science Labs., Inc., Westbury, N. Y., National Aeronautics and Space Administration Lewis Research Center Contract NASW-2235 Mode. 1, Rept. NASA CR-121208, GASL TR-781, 100p., March 1973. 33 refs.*

NTIS: N73-30754

A unified mathematical model in modular form is proposed for the description of the origin and disposition of combustion generated pollutants in gas turbines. The model includes kinetics, recirculation, turbulent mixing, multiphase flow effects, swirl, and secondary air injection. Subelements of the overall model have been applied to data relevant to laboratory reactors and practical combustor configurations. Comparisons between the theory and available data show excellent agreement for basic carbon monoxide/hydrogen/air chemical systems. For hydrocarbons the trends are predicted well including higher than equilibrium nitric oxide improved accuracy in fuel rich combustion is indicated, comparisons with actual jet engine data in terms of the effect of combustor inlet temperature is excellent. In addition, excellent agreement with data is obtained regarding reduced NO emissions with water droplet and steam injection. Comparisons of prediction made on swirling flame data show that while good agreement can be obtained additional work is required in terms of the turbulent transport properties. (Author abstract modified)

41237 **APTIC NO. 63457**

Fleming, R. D. and T. R. French

DURABILITY OF ADVANCED EMISSION CONTROLS FOR HEAVY DUTY DIESEL AND GASOLINE FUELED ENGINES. *Bureau of Mines, Bartlesville, Okla., Fuels Combustion Research Group, Environmental Protection Agency Interagency Agreement EPA-IAG-082(D), Rept. EPA-460/3-73- 010, 119p., Sept. 1973. 2 refs.*

NTIS: PB 232441/AS

Baseline and 1200 hour durability tests on 1973 gasoline and diesel engines designed for use in vehicles from 24,500 to 60,000 lbs gross vehicle weight were performed on dynamometer stands to evaluate the use of advanced light-duty vehicle emission controls on heavy-duty truck engines. Emission controls applied to the diesel engine were: injection timing, oxidation catalysts, and exhaust gas recirculation, while the emission controls used on the gasoline engine were manifold air injection combined with oxidation catalysts and exhaust gas recirculation. Measurements were made for carbon monoxide, hydrocarbons, oxides of nitrogen, and smoke (based on results from the Federal smoke emission test procedure). The NOx emissions could be significantly reduced by the use of exhaust gas recirculation while maintaining good system durability. Catalysts appeared sufficient for reducing CO and hydrocarbon emissions, though these emissions are not considered a serious problem from most diesel engines. Emission results are tabulated for both baseline and durability testing.

41238 **APTIC NO. 63543**

Gottschlich, Chad F.

NITROGEN OXIDE EMISSION FROM INDUSTRIAL BURNERS. *Heat Technol., 3(3):18-21, Fall 1973. 1 ref. (Presented at the AISE Annual Convention IHEA--AISE Pollution Abatement Panel Session, Chicago, Ill., 1973.)*

A series of burner/furnace tests was run to examine the variables that control nitrogen oxide emission. The burner types included nozzle mix and premix, tunnel, and radiant cup. Both natural gas and fuel oil were burned. The air/fuel ratio was varied from 53% to 130% of the stoichiometric air requirement. The furnace temperatures were varied from 2300 to 2800 F. Most tests were made with no air preheat, although a few were made with preheated air temperatures of 600 and 1000 F. All variables, except fuel type and method of mixing the fuel and air, significantly affected the nitrogen oxide emission. Preheat had the greatest effect. The nitrogen oxides varied from 4-250 ppm by volume. A comparison with thermodynamic analysis was made. (Author abstract modified)

41239 **APTIC NO. 65942**

Hawkins, A. E.

THE ELECTRICITY SUPPLY INDUSTRY. *Inst. of Fuel, London (England), Fuel Environ. Proc. Conf., Eastbourne, England, 1973, p. 55-82. (Nov. 26-29, Paper 5.)*

The British electrical generation and supply industry is reviewed with particular emphasis on its environmental impact. Topics covered include: site selection and development, including environmental restraints connected with limited land use; the handling and storage of conventional fuels, including the problem of dust blowing from coal handling plants and stock piles; combustion products from conventional fuels, including smoke arising from inefficient combustion, grit and dust from mineral impurities in fuel, sulfur oxides from fuel impurities, nitrogen oxides resulting partly from the fuel and partly from air used for combustion, and disposal problems associated with ash and dust collected by the arrestor plant; nuclear generation of electricity and problems associated with activated gases and particulates discharged to the atmosphere as well as the risk of radioactive discharges; secondary environmental effects associated with the conversion of fuel to heat energy; thermal pollution of natural waters, the discharge of warm air and water vapor from cooling towers; the conversion of mechanical power to electricity; and the distribution of electricity, including the concept of integrated environmental design.

41240 **APTIC NO. 65941**

Hetherington, A. F.

THE GAS INDUSTRY. *Inst. of Fuel, London (England), Fuel Environ. Proc. Conf., Eastbourne, England, 1973, p. 43-52. (Nov. 26-29, Paper 4.)*

The British natural gas industry is reviewed, with particular emphasis on its environmental impact. Sulfur emission from natural gas is negligible, being about one five-hundredth that of the other main fossil fuels used in industry. The total national emission for Britain is about 5 million tons per annum. Smoke emissions are nonexistent. Nitrogen oxide emissions from natural gas are proportional to the flame temperature, and simple methods of NOx reduction involve temperature reduction and control of secondary aeration. Studies are also cited concerning the safety of natural gas in indoor environments, with investigations on the formation and concentrations of carbon dioxide, carbon monoxide, and NOx being undertaken to recommend suitable designs for burners and heat exchangers. Natural gas plant damage in Great Britain, resulting from depriving tree and plant roots of oxygen needed for respiration, is cited as being minimal.

41241 **APTIC NO. 64096**

Hilt, M. G. and D. V. Giovanni

PARTICULATE MATTER EMISSION MEASUREMENTS FROM STATIONARY GAS TURBINES. *Preprint, American Society of Mechanical Engineers, New York and Inst. of Electrical and Electronics Engineers, New York, 10p., 1973. 14 refs. (Presented at the American Society of Mechanical Engineers/Institute of Electrical and Electronics Engineers Joint Power Generation Conference, New Orleans, La., Sept. 16-19, 1973, Paper 73-Pwr-17.)*

Particulate emissions from heavy duty gas turbines were measured. The various methods used and problems encountered in the attempt to determine consistent particulate emission levels are presented. One of the causes for inconsistent results from the test methods was the interference which occurred when hot exhaust gases were taken to standard conditions in a sampling train. The major interference problems were related to exhaust gas species which resulted from sulfur in the fuel, specifically sulfur dioxide and sulfur trioxide. Preliminary testing suggested that sampling locations and isokinetic sampling requirements expressed in some source testing methods for particulates may not be necessary. The measurement of gas turbine particulate matter levels is not a routine procedure. The inconsistencies in the definitions of particulate matter, in the emission regulations, and in the recommended sampling procedures cause problems in measurement. (Author summary modified)

41242 **APTIC NO. 63821**

Ishiguro, Ichiro

STUDIES ON AIR POLLUTION IN HIGHWAY TUNNELS. *(Jidosha tonneru no kuki osen no kenkyu). Text in Japanese. Kinki Daigaku Kogai Kenkyusho Kenkyu Hokoku (Kinki Univ. Pollut. Res. Inst. Rep.), no. 1:139-141, June 1973. 1 ref.*

The theoretical derivation of equations for estimating pollution concentrations in highway tunnels and in their vicinity is described. The air flow in the tunnel is governed by the piston effect of moving vehicles and the forced air flow by ventilation systems. The pollutant concentration is dependent on the air flow rate in each section of the tunnel. The basic equations for air flow rate in a tunnel were derived based on the piston effect which was handled as a negative resistant coefficient. With the value of piston effect coefficient, the flow rate in each section of the tunnel can be calculated when the velocity of vehicle and distance between vehicle heads are given.

41243 **APTIC NO. 64008**

Jennett, J. Charles, Bobby G. Wixson, Ernst Bolter, and James O. Pierce

ENVIRONMENTAL PROBLEMS AND SOLUTIONS ASSOCIATED WITH THE DEVELOPMENT OF THE WORLD S LARGEST LEAD MINING DISTRICT. *Society of Engineering Science, Pollut. Eng. Sci. Solutions, Proc. Int. Meet. Soc. Eng. Sci., 1st, Tel Aviv, Israel, 1972, p. 320-330, 1973. 7 refs. (June 12-17.)*

The world s most modern lead industries have developed in the remote Ozarks region of southeastern Missouri during the past 5 years. This industrial development has resulted in the release of lead, copper, zinc, cadmium, and other metal pollutants into a formerly unpolluted ecosystem. Due to this abrupt change, the mining district has become a unique area for studying the impact of trace metals on a wide variety of biogeochemical systems and for developing new techniques to control pollution. Lead concentrations in the soil averaged 17-32 ppm; zinc values ranged from 10-60 ppm; copper values ranged from 1.5-27 ppm; and cadmium values were generally below 0.5 ppm, ranging up to 2 ppm. Data is given on lead, copper, zinc, and sulfur concentrations in the soil in the area of a smelter. Concentrations generally decreased with increasing distance from the smelter. Heavy metal concentrations near highways and railroads indicated these were sources of pollution. The effects of the lead mines on water quality was also studied in mine-mill effluent studies. Several solutions to pollution in the area are mentioned.

41244 **APTIC NO. 65868**

Kaakinen, John W. and Roger W. Jorden

FATE OF TRACE METALS IN A COAL-FIRED POWER PLANT. *In: Transport and the Biological Effects of Molybdenum in the Environment, A Progress Report to National Science Foundation. Colorado Univ., Boulder, Molybdenum Project, Grant RANN GI-34814X, p. 102-127, 1973. 1 ref.*

Since a significant amount of molybdenum may be mobilized into the environment by fossil fuel combustion, especially in electricity generation, the fate of molybdenum and other trace metals in coal-fired power plants was studied. Trace element mass balance and mathematical modeling studies were made at one coal-fired power plant. Samples of all input and output streams of coal, ash, and water were obtained during 3 days of scrubber-precipitator tests when the plant was operated at full load. Sampling handling and analyses are described, and results for mercury, iron, molybdenum, strontium, naturally occurring radioactive species, and other trace metals are presented. Qualitative results showed significant enrichments of molybdenum and other relatively volatile metals in particulate emissions from the power plant. The model showed that prediction of the enrichments of trace metals, at least within certain bounds, was possible based on some measure of volatility of the respective form of each trace metal. Future studies are outlined.

41245 **APTIC NO. 64358**

Mellor, A. M.

SIMPLIFIED PHYSICAL MODEL OF SPRAY COMBUSTION IN A GAS TURBINE ENGINE. *Combustion Sci. Technol., 8(3):101-109, 1973. 33 refs.*

Heterogeneous processes were identified as important in determining levels of exhaust emissions from liquid-fueled gas turbine engines. From correlations of nitric oxide and carbon monoxide emissions indices with differential fuel injection pressure, a simplified physical model of the spray combustion process in a turbine combustor was developed. This model is consistent with previous experimental data obtained in this laboratory and assists in understanding the successes and failures of analytical combustor models available in the open literature. (Author abstract)

41246 **APTIC NO. 64002**

Middleton, John T. and Ellis F. Darley

CONTROL OF AIR POLLUTION AFFECTING OR CAUSED BY AGRICULTURE. *Society of Engineering Science, Pollut. Eng. Sci. Solutions, Proc. Int. Meet. Soc. Eng. Sci., 1st, Tel Aviv, Israel, 1972, p. 148-157, 1973. 14 refs. (June 12-17.)*

Air pollution affecting or caused by agriculture is generally reviewed. About half of the air pollutants in the U. S. come from transportation sources, fuel burning in stationary sources accounts for about 1/4, industrial processes account for about 1/6, and incineration and other waste disposal methods account for another 1/6. The pollutants from these sources interfere with visibility, damage property, irritate the senses, have adverse effects on public health and welfare, and damage vegetation and animals. The annual cost of directly observable air pollution damage to field, flower, fruit, and nut crops, and vegetables in the U. S. has been estimated to amount to about $80 million, of which nearly $26 million occurred in California. This loss to selected crops is somewhat less than 1/2% of the total annual cost of pollution from damage to health, materials, and residential property. Principal pollutants causing damage to plants are particulates, fluorides, ethene, nitrogen dioxide, ozone, peroxyacetyl nitrate, and sulfur dioxide. Agricultural sources of pollution are burning of agricultural wastes and forests, cotton ginning, grain handling and milling, fertilizer manufacturing, and kraft pulping. Various pollution control methods are reviewed. (Author abstract modified)

41247 **APTIC NO. 64202**

Phelps, Robert E.

AN ANALYSIS OF ASPHALT PLANT POLLUTION ELIMINATION DEVICES. *Oregon State Univ., Corvallis, Civil Engineering Dept., Construction Education and Research Foundation Rept. 3, 59p., June 1973. 19 refs.*

The sources and causes of air pollution in and around asphalt plants were investigated. Minimum air pollution standards require that the discharge into the atmosphere be at a mass rate of less than 40 lb of particulate matter/hr and that the emission standard of 0.1 gr/scf be met or exceeded. Particulates of concern are smoke, soot, raw fuel droplets, fly ash, silt, clay, and fine rock fragments. Smoke and soot can be virtually eliminated by maintaining a better balance between the fuel injected into the burner and the amount of air supplied for combustion. Proper preheating of the fuel oil prior to injection may also eliminate the formation of soot and smoke as well as the existence of raw fuel droplets. Fifteen to 30% of the air pollution problem associated with asphalt concrete production is occurring due to the transportation of materials within the asphalt plant proper or the fugitive dust. Remedies are suggested for eliminating maverick dust and for containing fugitive dust including paving. The exhausts from asphalt plant dryers are discussed and primary and secondary air treatment is analyzed. The conclusions favor the selection of baghouses over wet devices to provide adherence to Environmental Protection Agency standards, product quality, and economy. The Dryer-Drum process is analyzed. (Author summary modified)

41248 **APTIC NO. 64131**

Plungis, Don

AN EVALUATION OF A 350 CID COMPOUND VORTEX CONTROLLED COMBUSTION (CVCC) POWERED CHEVROLET IMPALA. *Office of Air and Water Programs, Washington, D. C., Emission Control Technology Division, Rept. 74-13-DWP, 13p., Oct. 1973.*

An evaluation of a series of tests on a 1973 Chevrolet Impala powered by a Honda Compound Vortex Controlled Combustion (CVCC) engine is described. The CVCC engine burns a heterogeneous air fuel mixture. In concept it is similar in some respects to the stratified charge engines of Ford and Texaco. The Honda CVCC engine obtains stratification with the use of a separately carbureted prechamber. Although the results were not consistent because of hot starting problems, the ability of the CVCC engine concept to meet statutory 1975/1976 hydrocarbon and carbon monoxide standards when applied to a full sized vehicle application was confirmed. Low cold start hydrocarbon and CO levels were repeatedly demonstrated during this testing. Although the statutory 1976 nitrogen oxides standard was not achieved, good NOx control was demonstrated even without the use of EGR. Aldehyde emissions from the CVCC engine were lower than from present production cars. The CVCC engine achieved low emission levels without the use of add on type devices or exhaust after treatment. (Author conclusions modified)

41249 **APTIC NO. 66028**

Roegener, H.

HEAT EMISSION BY WET COOLING TOWERS. *(Waermeabgabe durch Nasskuehltuerme). Text in German. Umwelt Aktuel., (6):35-44, 1973. 9 refs. (Presented at the conference held during Environment 72, Stuttgart, Germany, June 30-July 9, 1972.)*

Theoretical and practical aspects of the nuisances caused by wet cooling towers in thermal power plants are discussed. The haze emitted by such cooling towers is formed inside the tower before emission, and the water vapors condensing after emission evaporate before fallout as the maximum rate of settling is about 5 cm/sec. The precipitation as observed rather often around cooling towers is consequently due to the entrainment of water droplets of substantially larger size, and these water droplets also contain largely the same salt concentration as the cooling water in the cooling tower, while condensed droplets are saltfree. Droplet contents up to 2 g/liter and salt concentrations amounting to 80% of that in the cooling water were measured on a cooling tower without droplet separator. It was possible to prevent precipitation around the cooling tower and to reduce the salt emission by the installation of a droplet separator.

41250 **APTIC NO. 64043**

Russell, J. A., J. D. Tosh, A. A. Johnston, J. V. Moffitt, C. A. Moses, and J. T. Gray

PERFORMANCE OF ARMY ENGINES WITH LEADED AND UNLEADED GASOLINE. PHASE I - LABORATORY (INTERIM REPORT). *Southwest Research Inst., San Antonio, Tex., Army Fuels and Lubricants Research Lab., Army Mobility Equipment Research and Development Center Contract DAADO5-72-C-0427, AFLRL 21, 151 p., Jan. 1973.*

NTIS, DDC: AD-766 760

Six different types of Army engines were endurance-tested on dynamometers for 125 hr each, using three grades of military Federal specification gasoline having typical conventionally leaded, low lead, and unleaded concentrations of Pb antiknock additives, respectively. The engine types tested were as follows: L-141 (M151 Truck), Chrysler 75M (M113 Armored Personnel Carrier, MIL STD 2A016 (1.5 kW Generator Set), MIL STD 4A032 (3.0 kW Generator Set), MIL STD 4A084 (10-kW Generator Set), and AVSI 10790-6A (M88 Tank Recovery Vehicle). The gasolines used and their Pb contents were as follows: MIL-G-46015 (MR) Combat Referee, conventionally leaded (2.17 g/gal), VV-G-001690, Low Pb (0.5 g/gal), and VV-G-001690, unleaded (0.03 g/gal). All six engine types performed satisfactorily on all gasoline blends from the standpoints of catastrophic failure, excessive valve or cylinder wear, engine power output and fuel and oil consumption, and emission degradation. There were no well- defined fuel-to-fuel effects on degree or pattern of emissions. This lack of pattern may or may not be due to masking from over-riding engine-to-engine differences for any particular engine type. There were no timewise emissions degradation effects for the 125 hr tests. Durations considerably longer than this are evidently required to identify any such effects. (Author abstract modified)

41251 **APTIC NO. 63450**

Sissons, Bill

CALCULATING THE WEIGHTS OF DRY AND WET FLUE GAS. *Chem. Eng., 80(13):134, June 11, 1973.*

A mathematical method is presented for calculating the weight of flue gas per pound of fuel burned. The quantity of wet gas may be calculated by adding the dry weight to the weight of water equivalent to the total hydrogen in the as-fired fuel. A set of scales is also presented which can be used with a ruler to determine wet and dry weights without necessitating use of the mathematical formula.

41252 **APTIC NO. 65791**

Tadmor, J.

AIR POLLUTION IN ISRAEL. *Isr. J. Technol., 11(6):431-434, 1973. 3 refs.*

The sources of air pollution in Israel are analyzed. About half the total amount of air pollutants from combustion of fuel in Israel comes from transportation, about one quarter from power plants, and 12-18% from industry. About 99% of the carbon monoxide and 80% of the hydrocarbons are emitted by vehicles. Sulfur dioxide is mainly emitted by power plants (approximately 60%) and industry (31 to 38%). The main sources of nitrogen oxides are the power plants (33 to 34%), vehicles (29-33%), and industry (13 to 20%). The sources of particulate matter are vehicles (38 to 43%), industry (14 to 22%), agriculture (19 to 22%), and power plants (10 to 16%). Approximately equal pollution damage from fuel combustion is caused by vehicles on the one hand and power stations and industry on the other.

41253 **APTIC NO. 63877**

Thomas, G.

INCINERATION OF FRESH AND DIGESTED SLUDGE. *(Frisch- und Faulschlammverbrennung). Text in German. Muench. Beitr. Abwasser Fischerei Flussbiol., 24:122-145, 1973. 6 refs.*

The operating principles of the rotary kiln, the story furnace, and the fluidized bed furnace are reviewed and their efficiency in burning undigested and digested sludges from waste water purification is discussed. Methods for cleaning the flue gases from these incinerators are described. The rotary kiln has not yet been used for the incineration of sewage sludge alone to any great extent. In combination with trash, incineration in this furnace is feasible without major difficulties provided the sludge is charged on top of the trash in a thickened state. The story furnace is suitable for the incineration of sewage sludge. In the drying zone the sludge is heated to 90 to 95 C. Upon falling into the combustion zone the temperature jumps to 800 C. The gas velocity in the furnace is low, which has the advantage that only 5 to 10% of the total ash is found in the flue gas, whereas this percentage is 20 to 40% in the rotary kiln and 95 to 100% in the fluidized bed furnace. In a newer model of the story furnace the burners are installed in chambers attached to the combustion zone so that only gases with temperatures of 900 to 1000 C enter into these zones. The fluidized bed furnace is preferably used for the incineration of oil-containing sludges from refineries. These furnaces are increasingly equipped with scrubbers which remove not only dusts from flue gases but also acid components. The flue gases contain all mineral components of the sludge as well as part of the sand of the fluidized bed. The operation of cylones (used mostly for preliminary dust collection) and electrostatic precipitators is reviewed.

41254 **APTIC NO. 63460**

Radian Corp., Austin, Tex.

EVALUATION OF LIME/LIMESTONE SLUDGE DISPOSAL OPTIONS (FINAL REPORT). *Office of Air and Water Programs Contract 68-02-0046, Rept. Environmental Protection Agency-450/3-74-016, 167p., Nov. 1973. 60 refs.*

NTIS: PB-232022/AS

The environmental effects from the disposal of sludge created by lime and limestone flue gas desulfurization systems at steam electric power plants in Ohio are discussed in a study of the technology of sludge disposal. The environmental effects are dictated by the chemical and physical properties of the material, and these properties may vary widely for different operations. Lime scrubbing processes ordinarily produce sludges containing calcium sulfite, 1/2 water, calcium hydroxide, calcium sulfate, 2H2O, and calcium carbonate. For coal fired installations where efficient particle removal is not installed upstream of the wet lime/limestone absorbers, such sludges can contain large quantities of coal ash. The SO2 removal efficiency will vary from one flue gas desulfurization system to the next as a function of local requirements. Air pollution control regulations adopted by the State of Ohio call for reduction of SO2 emissions in certain high priority areas of the state to 1.8 mg/Kcal by July 1, 1975. An SO2 removal efficiency of about 85% will be required to meet the standard for plants burning 3.33% sulfur coal. (Author abstract modified)

41255 **APTIC NO. 63475**

Dept. of the Air Force, Washington, D. C.

DRAFT ENVIRONMENTAL STATEMENT ON UNITED STATES AIR FORCE SPACE LAUNCH VEHICLES. *115p., Aug. 1973. 48 refs.*

NTIS: EIS-AA-73-143LD

A draft environmental statement including air pollution effects is presented for the launching of the Titan III, Atlas, and Scout space launch vehicles. The solid rocket motors used in the Titan III C and D and the Scout Master booster system emit three materials of concern into the lower atmosphere: hydrogen chloride, carbon monoxide, and aluminum oxide. The two gaseous materials are potentially toxic, while the Al2O3 is in particulate form and is a nuisance dust which may evoke some cellular response in lung tissues. Other forms of air pollution, including oxides of nitrogen and Aerozine 50 can occur as the result of venting or spilling certain toxic propellants. Any air pollution resulting from accidents or on-pad aborts will be less than Public Emergency Limits established by the National Academy of Science and would not be expected to cause damage to life or property. Such air pollution is a transient effect expected to last for only a few minutes over any ground locations. (Author summary modified)

41256 **APTIC NO. 64045**

Syracuse Univ. Research Corp., New York

INCINERATION OF PLASTICS FOUND IN MUNICIPAL WASTES (FINAL REPORT). *Environmental Protection Agency Grant EP-00304, EPA-670/2-73-087, 245p., Sept. 1973. 47 refs.*

NTIS: PB-223 651

The combustion efficiency of plastics when burned in several types of laboratory incinerators was determined. The laboratory units were designed to simulate the primary flame zones of municipal incinerators. The parameters of efficiency considered were percent of material consumed, the chemical cleanliness of the gaseous effluent, the rate of production of fly ash, and the more obvious environmental effects of the gaseous effluent, fly ash, and residue ash. There are three categories of plastics, the first two classes, when properly burned, give clean and innocuous effluents. Class 1 includes polyethylene, polystyrene, and polypropylene. When burned improperly, there is usually increased soot and occasionally sharp increases of carbon monoxide. The second class contains the thermosetting resins and some of the nitrogen containing thermo-plastics. When burned under conditions that were less than optimum, they often yield effluents which include hazardous concentrations of aldehydes, CO, ammonia, nitrogen oxides, and cyanides. The most hazardous and most sensitive of this group is urea- formaldehyde. Class 3 is dominated by polyvinyl chloride, which yields hazardous and corrosive effluents no matter how burned. Some of the plastics when improperly burned are hazardous to plants and animals. (Author abstract modified)

41257 **APTIC NO. 64275**

National Industrial Pollution Control Council, Railroad and Rail Equipment Sub-Council

EXHAUST EMISSIONS FROM DIESEL LOCOMOTIVES. *(April 1973. 2 refs.*

GPO

Although railroads are the lowest polluter of the environment among the major modes of transportation, they do produce some carbon monoxide, oxides of nitrogen, and urburned hydrocarbons. Using a duty cycle representing the working methods encountered in roadhaul operation, the amounts of exhaust materials emitted by diesel-electric locomotive engines were determined. They vary with engine type, method of air u5ply, and engine load. This diesel exhaust emission study is described in detail including locomotives tested, instrumentation, test procedures, data analysis, and results. Concentrations of CO were determined at various throttle positions on the four locomotives tested. Peak concentrations occurred at throttle position No. 6 and decreased at higher throttle settings. Differences in CO concentrations at the various throttle positions were evaluated to determine if the data were statistically different with respect to the locomotives tested. Specific concentrations of unburned HC plus NOx were determined as a function of throttle position, and statistical differences for the different engines were determined. Aldehyde concentrations and visible emissions were also measured. Specific concentrations of exhaust emissions over the entire duty cycle in g/hp/hr were 0.2 CO and 13.5 HC + NOx for locomotive SP-8803 (EMD), 2.5 CO and 13.4 HC + NOx for SP-8816 (EMD), 4.5 CO and 18.4 HC + NOx for SP-8608 (GE), and 4.5 CO and 15.0 HC + NOx for ATSF-3514 (EMD). Measurements of visible emissions using available instrumentation and methodology were inconclusive.

41258 **APTIC NO. 65948**

Dept. of Trade and Industry, London (England), Economics and Statistics 2 Div.

ENERGY TRENDS. *Inst. of Fuel, London (England), Environ. Proc. Conf., Eastbourne, England, 1973, p. 141-147. 6 refs. Nov. 26-29, Paper 12.)*

Past trends and possible future developments in energy consumption in England are discussed in relation to environmental consequences. The replacement of coal by oil in industry has probably reduced pollution at the point of consumption, with a relocation of the pollution associated with the production of primary fuel from coal-mining areas to refinery sites. Rising natural gas consumption has led to environmental benefits both by replacing less clean fuels and by displacement of town gas and its associated plant. Increased nuclear generation of electricity also appears to be resulting in pollution reduction. The forecast growth in energy consumption is expected to add to the risks of environmental damage, though this can be expected to increase at a slower rate than energy consumption because of the steady movement towards cleaner fuels and the increasing efficacy of pollution control.

1972

41259 **APTIC NO. 63616**

Brail, Richard K.

AIR QUALITY IMPLICATIONS OF FUTURE TRANSPORTATION SYSTEMS. *Society of Automotive Engineers, Inc., New York, Environmental Protection Agency, and Dept. of Transportation, Soc. Automotive Engrs. Int. Conf. Transp. Environ., Proc., Washington, D. C., 1972, Part I, p. 306-314. 22 refs. (May 31-June 2, Paper 720645.)*

The contribution of future transportation system configurations to air pollution is examined. The necessary linkages between transportation and land use systems are recognized, and projections of population growth and distribution are made. Although future air quality resulting from transportation will be markedly improved over current pollution levels, the increased vehicle-miles traveled yearly in the U. S. will require substantial investment in transportation networks and shifts in demand for various transportation modes. Extrapolating from current trends in population growth and distribution, in the year 2000, the nation will be dominated either by the automobile or a transportation mode which has similar characteristics of flexibility and convenience. If the automobile is still the dominant form, air quality will be measurably improved in 2000 because of 1976 Federal standards. This reduction in pollution will occur even if the total vehicle-miles yearly increases by more than a factor of three. A great increase in travel in the year 2000 will require either massive spending for new highways or shifts in demand for different transportation modes. A coherent vehicle-mile minimization policy may be needed for future transportation planning. (Author abstract modified)

41260 **APTIC NO. 65925**

Dilloway, A. James

EUROPE S POWER SUPPLY IN THE 1980S. *Energy Int., 9(4):29-35, April 1972. 8 refs.*

Europe, as a key area for experiment in power technology and system economics, is also faced by new environmental constraints which must influence policy and investment in the coming decade. The likely outcome of emerging trends within the region is discussed. Changes in the main parameters of the power situation between 1968 and 1980 are discussed. Determinants and indicators of electric energy demand in Europe discussed include population, Gross Domestic Product, total primary energy input, and gross electric energy consumption requirements. A summary is given of European trends in power consumption including total gross consumption, net consumption, percentages consumed by industry, domestic, and transport, domestic use, and system load factor. The energy demand and consumption trends are discussed for the economic commission for Europe and for an interconnected Europe. Europe s projected generating capacity and maximum demand in 1980 are compared with the situation in 1968. The effects of energy production of the environment are also reviewed.

41261 **APTIC NO. 63607**

Ephraim, Max, Jr.

STATUS REPORT ON LOCOMOTIVES AS SOURCS OF AIR POLLUTION. *Society of Automotive Engineers, Inc., New York, Environmental Protection Agency, and Dept. of Transportation, Soc. Automotive Engrs. Int. Conf. Transp. Environ., Proc., Washington, D. C., 1972, Part I, p. 9-13. 2 refs. (May 31-June 2, Paper 72064.)*

The diesel electric locomotive as a source of gaseous emissions is reviewed. Locomotive operation is outlined to provide an understanding of diesel engine application, operation, and controls. Methods of evaluating gaseous emissions are offered for consideration as industry standards. Present exhaust emission levels are presented. Specific recommendations are offered to the locomotive manufacturers, the railroads, and the governmental regulating bodies to effect improved exhaust emission levels. (Author abstract)

41262 **APTIC NO. 63609**

Field, Robert

THE ENVIRONMENT AND THE BUS. *Society of Automotive Engineers, Inc., New York, Environmental Protection Agency, and Dept. of Transportation, Soc. Automotive Engrs. Int. Conf. Transp. Environ., Proc., Washington, D. C., 1972, Part I, p. 28-36. (May 31-June 2, Paper 720607.)*

The emission of pollutants by buses are reviewed. Diesel bus exhaust can react with solar radiation to form smog. Another interesting aspect of diesel exhaust is the dependence of emissions on the air/fuel ratio. A rich mixture causes large amounts of hydrocarbons and carbon monoxide but very small amounts of nitrogen oxide. A stoichiometric ratio decreases HC and CO but increases NOx to its highest values. A lean ratio causes CO emission to drop to a very low level, while HC increases and NOx decreases. Diesel buses also produce unpleasant odors, noise, and visible smoke. An environmental improvement package has been developed to reduce HC by 90%, CO by 40%, smoke, and odor. It consists of a low sac needle injector, a vertical exhaust, an exhaust muffler reactor, an air induction system, and a resilient engine mounting. This system meets Federal NOx, CO, and HC emission levels and reduces smoke to an invisible level.

41263 **APTIC NO. 63532**

Howe, Robert H. L.

SOME QUALITATIVE DATA ON THE BURNING OF CERTAIN PLASTIC MATERIALS. *Inst. of Advanced Sanitation Research, International, Prog. Hazardous Chem.*

Handl. Disposal, 3rd, Proc. Symp., Indianapolis, Ind., 1972, p. 237-241. 1 ref.

The combustion of plastic materials is viewed as to the resultant chemical oxidation causing large amounts of combustion gases that may be emitted if burned without proper control. Qualitative data about the gases that are generated during the burning process are presented, in order to provide necessary understanding of the possible hazards involved. One table presents an estimate of total plastics in municipal refuse in 1966. Another table presents results of burning plastics with combustion products at 350 F and 1600 F.

41264 **APTIC NO. 63620**

Morrison, D. W.

AIR QUALITY – COMMERCIAL VEHICLE EMISSIONS. *Society of Automotive Engineers, Inc., New York, Environmental Protection Agency, and Dept. of Transportation, Soc. Automotive Engrs. Int. Conf. Transp. Environ., Proc., Washington, D. C., 1972, Part II, p. 11-19. (May 31-June 2.)*

Estimated earthmoving equipment emissions are given from various sources. The estimated off-highway machinery emissions versus on-highway diesels for 1969 in 10 to the 6th power tons/yr are, respectively, 0.23 and 0.2 hydrocarbons, 0.116 and 1.0 carbon monoxide, 0.324 and 1.1 nitrogen dioxide, 0.056 and 0.1 sulfur dioxide, and 0.01 and 0.1 particulates. The diesel engine is the principal power source used in railroad locomotives. High horsepower turbocharged engines have reduced smoke compared to lower horsepower normally aspirated or Roots blown engines. Gaseous emissions from diesel locomotives are about 1/4 as much as emissions from highway trucks based on a gross ton-mile basis. Diesel engines in buses produce low levels of carbon monoxide, hydrocarbons, and oxides of nitrogen, as well as smoke, odor, and noise. A control package for buses was developed consisting of a low SAC needle injector, a vertical exhaust, an exhaust muffler reactor, an air induction system, and a resilient engine mounting. Gas turbines can also be used in buses to give low emissions. Emissions from trucks depend on vehicle load factors, engine characteristics, and type of trucks. Generally heavy duty trucks contribute 0.27% of the HC emissions from transportation sources and 0.14% of total HC emissions, 2.95% of CO emissions from transportation sources and 1.86% of total CO emissions, and 6.91% of NOx emissions from transportation sources and 2.71% of total NOx emissions. Considerable research has been done on reducing truck emissions including more efficient use of trucks. Federal emission regulations are mentioned.

41265 **APTIC NO. 64192**

Remenyi, K. and L. Voros

TESTS FOR FLUIDIZATION AND PNEUMATIC PULSATION OF PULVERIZED COAL WITH A SPECIAL VIEW TO SEPARATION TESTS. *(Versuche zur Fluidisation und pneumatischen Pulsation von Kohlenstaub-Mahlgut unter besonderer Beruecksichtigung der Sichtungspruefung). Text in German. Aufbereitungs-Technik, 13(12):760-763, 1972. 3 refs.*

Dry fluidization and pneumatic pulsation tests were carried out with ground pit coal middlings from the Pecs area and brown coal from the Ajka area. Separation can be realized only by pulsation with very small air volumes. Satisfactory results could be obtained by this method only at grain sizes of over 0.2 mm. The ash content was highest in the 0.2-0.5 mm grain fraction. The separation of crushed coal by pneumatic pulsation is suitable for the control of the ash content in coal to be used in thermal power plants.

41266 **APTIC NO. 63610**

Rote, D. M., I. T. Wang, L. Wangen, J. Pratapas, Lois Leffler, and Glen Cato

MONITORING AND MODELING OF AIRPORT AIR POLLUTION. *Society of Automotive Engineers, Inc., New York, Environmental Protection Agency, and Dept. of Transportation, Soc. Automotive Engrs. Int. Conf. Transp. Environ., Proc., Washington, D. C., 1972, Part I, p. 56-85. 15 refs. (May 31-June 2, Paper 720611.)*

The airport air quality monitoring program conducted at O Hare and Orange County Airports is discussed, and preliminary results are presented. Aircraft and related ground vehicular data are presented along with a summary of engine emissions. These data are discussed, and their use in the activity simulation models is described. The models used for activity simulation and calculation of air quality are described briefly. The relationships between aircraft operating modes and amounts of emissions and between type of engine and emissions are discussed. Substantial reductions in hydrocarbon and carbon monoxide emissions can be obtained by reducing the taxi-idle time. Airborne monitoring at Orange County Airport showed relatively small variations in pollutant concentrations, except when individual jet exhaust plumes were crossed; at O Hare there were indications of increased concentrations in the vicinity of approach and departure paths at flight altitude several miles from the airport. Ground level particulate and coefficient of haze concentrations varied from one site to another within the airport, corresponding to emission patterns and wind directions. Particulate levels were higher inside the airport than in rural areas. Ground level gaseous pollutant concentrations were larger inside the airport than outside. Nitric oxide was a particularly sensitive indicator of airport emissions. (Author abstract modified)

41267 **APTIC NO. 63429**

Rummel, R. W.

SUPERSONIC TRANSPORT ROUTES. *Preprint, 20p., Feb. 15, 1972. 23 refs.*

Future flight patterns and frequency for supersonic transports (SST) are predicted. Route patterns must be postulated to enable prediction of the global distribution of SST effluent products in order to explore their effect on the ecology. Two cases are presented, both of which are appropriate for use as models for the calculation of the worldwide distribution of SST emission products. The first case is the for Concorde only, assuming no U. S. SST. The other case assumes that both the Concorde and the U. S. SST or the equivalent thereof exists. Peak SST operations were assumed to have been developed by 1990 on the basis that technology would likely produce improved different modes by that time.

41268 **APTIC NO. 63842**

Sadaki, Keisuke and Ikuhei Sekine

THE SMOKE OF DIESEL ENGINE. *(Dizeru kikan no haien). Text in Japanese. Tomakomai Kogyo Koto Senmon Gakko Kiyo (Rep. Tomakomai Tech. Coll.), no. 7:27-30, March 1972. 2 refs.*

Using a precombustion chamber diesel engine, the effects of load, mixture ratio, cooling water temperature, rotational speed, and injection time on the smoke concentration were investigated. The amount of smoke emission varies with the air volume, fuel consumption rate and mixture ratio. The smoke concentration increases linearly with the increase in load and fuel-air ratio. The effect of cooling water temperature on the smoke concentration was of significance. At temperatures below 60 C, the smoke concentration increased greatly, while it remained almost constant at temperatures above 80 C. The increase at lower temperatures is presumably attributable to the slight increase in fuel-air ratio with decline in temperature. At the high speed of 1150-1300 rpm, the mixture ratio and exhaust gas temperature remain constant, and so does the smoke concentration at all loads. At lower rotational speeds, the smoke concentration tended to increase. The smoke concentration becomes higher with the early injection time, since the combustion takes place mostly in the precombustion chamber where air-fuel ratio is low, resulting in incomplete combustion. In the case of delayed injection time, the combustion takes place mostly in the main combustion chamber, resulting in the complete combustion and lower smoke concentration.

41269 **APTIC NO. 63608**

Sherbinsky, Mark

CHARACTERISTIC EMISSIONS OF HEAVY CLASS INTERCITY TRUCKS. *Society of Automotive Engineers, Inc., New York, Environmental Protection Agency, and Dept. of Transportation, Soc. Automotive Engrs. Int. Conf. Transp. Environ., Proc., Washington, D. C., 1972, Part I, p. 14-22. 3 refs. (May 31-June 2, Paper 720605.)*

The heaviest class of intercity trucks is examined using the 1967 Census of Transportation to establish a representative sample of vehicles with truck-miles as the major delineator. Representative road types and vehicle loading factors are selected. Computer simulation of the vehicle and road is used to establish histograms of percent engine load versus engine rpm. This is then combined with modal emission levels to allow projection on a weighted truck-mile basis, to the entire intercity population of this class vehicle. Heavy class is defined as over 26,000 lbs. Compared to nationwide emission estimates, heavy intercity trucks account for 0.27% of the hydrocarbon emissions from transportation sources, 0.14% of the total HC emissions, 2.95% of the carbon monoxide emissions from transportation sources, 1.86% of the total CO emission, 6.91% of nitrogen oxide emissions from transportation sources, and 2.72% of total NOx emissions. (Author abstract modified)

41270 **APTIC NO. 63568**

Sotola, Frantisek, J. Vrtek, J. Pavek, and J. Klima

CLEANING OF TANDEM FURNACE WASTE GASES. *(Cisteni odpadnich plynu u tandemovych peci). Text in Czech. Hutnik (Prague), 22(10):371-376, 1972.*

The waste gases from the basic oxygen steelmaking process have a carbon monoxide content of 5.5 to 40%, depending on the process conditions. By structural changes, especially by relocating the oxygen-blowing lances, the average CO content was lowered to less than 1%; only in exceptional cases did it reach 2%. For the removal of dust particles, the venturi scrubber was the most effective. Water containing a polyelectrolyte (Nalco 673), was injected into the separator and removed the dust as a sludge which was easily disposed.

1971

41271 **APTIC NO. 64125**

Busso, R.

POLLUTION OF ATMOSPHERE WITH THE PRODUCTS OF MUNICIPAL WASTES INCINERATION. *(Zanieczyszczanie atmosfery produktami spalania odpadkow miejskich). Air Conserv. (English translation from Polish of: Ochrona Powietrza), 5(2):26-35, 1971. (Presented at the Franco-Polish Symposium, Paris, France, Nov. 1969.)*

NTIS: TT 72-54022/2

The incineration of municipal wastes and characteristics of pollutants emitted into the atmosphere from incineration are discussed. Types of wastes, types of incineration methods, sources of pollution, chemical reactions inside the incinerator, experimental work, and industrial installations are discussed. Poorly conducted combustion with ordinary dust removal leads to the emission of combustion gases containing aldehydes, ketones, acids, alcohols, esters, nitryl compounds, amides, amines, nitrogen compounds, chlorine compounds, sulfur compounds, aliphatic hydrocarbons and aromatic hydrocarbons. In special cases, the concentration of certain toxic compounds such as formaldehyde attains the level of some hundred mg/N cu m. The sulfur dioxide and trioxide concentration of the condensate, with the combustion gases having a temperature of 0 C, can be considerable; pH can be between 1 and 2, even though the combustion process is well-regulated.

41272 **APTIC NO. 64229**

Jorden, Roger M.

ENVIRONMENTAL RECONNAISSANCE OF SOURCES AND ROUTES OF TRANSPORT OF MOLYBDENUM. *In: An Interim Progress Report for an Exploratory and Planning Phase of an Interdisciplinary Study of Transport and Biological Effects of Molybdenum in the Environment. Colorado Univ., Boulder, The Molybdenum Project, National Science Foundation Grant GI 30014, NSF/RA/E-72-445, p. 13-41, Dec. 1971. 6 refs.*

NTIS: PB-222 821

Molybdenum in fossil fuels and atmospheric particulates was investigated in a study of the sources and routes of transport of Mo. Miscellaneous fossil fuel and particulate samples were obtained and analyzed using X-ray fluorescence. The concentration of Mo in the ashes of crude oil and residual fuel oil ranged from 276 to 9750 ppm. The ash of a crude oil retorted from shale gave the highest concentration of Mo. These high concentrations combined with the fact that fuel oil burning furnaces usually have minimal particulate control devices indicate that burning heavy fuel oil may be a significant source for the release at atmospheric Mo. The Mo concentrations measured in samples of coal, coal ash, and fly ash were not accurate because of fluorescing interference from the presence of strontium and zirconium. Atmospheric particulate samples from two sites in Pueblo, Colo., were collected and analyses were qualitatively similar to coal ash samples with respect to metal content except that considerably more lead was present. Coal contains as high as 6000 ppm Mo and the potential for release exists and needs to be investigated. More importantly, fuel oil burning is in vogue for power production, and the high levels of Mo in the fuels combined with the lack of use of control devices indicates a potential high release.

41273 **APTIC NO. 64274**

Jorden, Roger M.

ENVIRONMENTAL RECONNAISSANCE OF SOURCES AND ROUTES OF TRANSPORT OF MOLYBDENUM. *In: An Interdisciplinary Study of Transport and Biological Effects of Molybdenum in the Environment (Interim Progress Report). Colorado Univ., Boulder, Molybdenum Project, National Science Foundation Grant GI 30014 Rept. NSF/RA/E-70-005, p. 13-41, Dec. 1971. 6 refs.*

NTIS: PB-222 821

The analysis of molybdenum in fossil fuels and atmospheric particulates by X-ray fluorescence is discussed. The concentrations of Mo in the ashes of crude oil and residual fuel oil range from 276 to 9750 ppm. The ash of a crude oil retorted from shale gave the highest concentration of Mo. These high concentrations combined with the fact that fuel oil burning furnaces usually have minimal particulate control devices indicate that burning heavy fuel oil may be a significant source for the release of atmospheric Mo. The Mo concentrations measured in samples of coal, coal ash, and fly ash were not accurate due to the fluorescencing interference of both strontium and zirconium. Atmospheric particulate samples from two sites in Pueblo, Colo. were qualitatively similar to coal ash samples with respect to metal content except that considerably more lead was present. Progress has been made in beginning the study of Mo and several other trace metals emitted by fossil fuel burning power plants. Coals contain as high as 6000 ppm Mo and fuel oil burning is in vogue for power production. The high levels of Mo in these fuels combined with the lack of use of control devices indicates a potential high release.

41274 **APTIC NO. 64185**

Kaup, F.

STATE OF THE ART OF AUTOMOTIVE EXHAUST DECONTAMINATION. *(Stand der Abgasentgiftung von Kraftfahrzeungen). Text in German. In: Technical Aspects of Road Safety. Rept. 71, CIDITVA 47-9.71, p. 3.1-3.6, Sept. 1971.*

The state of the air of technical possibilities to abate the emissions of harmful and toxic components in automotive exhaust is described. Considerable reduction in the nitrogen oxide emissions, and moderate abatement of the hydrocarbon and carbon monoxide emissions are expected from fuel atomization by means of an air jet impacting the fuel jet. Exhaust gas afterburning combined with an improved suction system is seen as the best solution for exhaust emission abatement for spark-ignition engines. Catalytic afterburners have the disadvantage of having limited life and requiring a large space. Wankel engines, the improved design of the Stirling engine, and the lithium battery-powered electric motor have the best chance of being used as power plants in the future. However, conventional engine designs are expected to prevail during the next 10 to 20 years.

41275 **APTIC NO. 64175**

Krause, U. and J. Wasilewska

ANALYSIS OF SULFUR DIOXIDE EMISSION INTO THE ATMOSPHERE FROM THREE IRON AND STEELWORKS. *(Analiza emisji dwutlenku siarki do atmosfery z trzech hut zelaza i stali). Air Conserv. (English translation from Polish of: Ochrona Powietrza), 5(5):19-28, 1971. 9 refs.*

NTIS: TT 72-54022/5

Sulfur dioxide emissions into the atmosphere from two process and one raw amterial iron and steelworks were measured. A comparison was made of the annual sulfur dioxide emission from one plant determined on the basis of SO2 concentration measurements in combustion gases and from sulfur balances. The emissions into the atmosphere from the different production departments of the different plants were determined. At plant A, 35.5% of the SO2 was from the repair and mechanical department, rolling mill, wire drawing mill, pickling department, and welded pipes department; 16.1% was from the cast iron foundry; and 48.4% was from the roll foundry. At plant B, 10.6% of the SO2 was from the rolling mill, 11.2% from the coking plant, 1.2% from railway transportation and other nonorganized sources, 60.9% from the sintering department 4.3% from the blast furnaces, 3.1% from the steel mill, and 8.7% from the power station and boiler. At plant C, 50.8% of the SO2 emissions were from the rolling mill, 21.5% from the boiler, 12.4% from the electric and open hearth steelmaking plant, 1.1% from the cast steel foundry, 0.9% from the cast iron foundry, 9.9% from the wire drawing department, and 0.4% from other sources. Various methods to control SO2 emissions at these plants are discussed.

41276 **APTIC NO. 64348**

Mangiarotty, R. A.

AIR POLLUTION FROM AIRCRAFT (PAPER VI). *In: The Fluid Dynamics Aspects of Air Pollution Related to Aircraft Operations. Dept. of Trade and Industry (England), Advisory Group for Aerospace Research and Development-AR-55, p. 41-53, 1971 (?). 2 refs.*

Current work being conducted in the United Kingdom in the following areas related to aircraft air pollution is discussed. The areas are: jet engine pollution in the neighborhood of airports - its generation, its reduction by proper combustion design, and its dispersal by winds; smoke trails; and pollution at high altitudes due to jet engine discharge, with its problems of chemistry and dispersion. Appendices are given describing emissions from gas turbine engines, air pollution at Heathrow airport from April to September 1970, and pollution of the stratosphere by the exhaust products of the SST. The main emissions from gas turbines are unburned fuel, aldehydes, sulfur oxides, carbon monoxide, smoke, and nitric oxide. In measurements at Heathrow, the ground level concentrations of sulfur dioxide and possibly of smoke decreased in the air moving across the airport. The concentrations of CO due to air traffic movements compared with road traffic emissions at the airport. Concentrations of nitrogen oxides at the perimeter of Heathrow were lower than typical values found in Central London; even near the runway and in the jet exhaust, they were not higher than maximum values recorded in London. Basically, the airport did not add significantly to the pollution levels in adjacent areas, and in fact diluted concentrations. Suggestions have been made that SSTs could change the Earth s radiation balance due to increased water vapor in the stratosphere, change the radiation balance due to increased particulate content in the stratosphere, cause a sulfate layer, affect the radiation balance due to contrail formation, increase mother-of-pearl clouds due to increased stratospheric humidity, and cause changes in the ozone layer due to water and NOx.

41277 **APTIC NO. 64238**

Pociecha, Z.

ATMOSPHERIC CONTAMINATION WITH HYDROGEN CYANIDE FROM BLAST FURNACE GAS PURIFICATION PLANTS. *(Skazenie atmosfery cyjanowodorem w oczyszczalniach gazu wielkopiecowego). Air Conserv. (English translation from Polish of: Ochrona Powietrza), 5(6):23-41, 1971. 7 refs.*

NTIS: TT-72-54022/6

The effluents from blast furnace stack gas wet purification plants contain high concentrations of simple cyanides. The cyanides undergo an intensive hydrolysis in an aqueous solution. The effects of solution temperature, pH, initial concentration of cyanides in solution, and ventilation number upon the degree of atmospheric pollution by the desorbed hydrogen cyanide are presented. On the basis of semitechnical and industrial tests it was proved that the atmospheric contamination with desorbed HCN considerably exceeds the standards adopted of 0.3 mg/cu m. In the case of rooms with insufficient ventilation, the HCN concentration may achieve 145 mg/cu m at a temperature of 20-25 C, even if the concentration of the cyanides in the effluents amounts only to 25 mg/l. The pH value of effluents and simple cyanide solutions is decisive for the actual concentration of undissociated HCN in the solution. At a pH of about 7, the cyanides appears in the solution almost exclusively in the form of undissociated HCN; at a pH of 11 they appear as cyanide ions. The HCN desorption from aqueous solutions of simple cyanides or effluents containing cyanides, proceeds without difficulties. Considerable value of the desorption coefficient determined on a laboratory scale points to the fact that in the surroundings of devices in which there are effluents containing cyanides, the degree of air pollution with desorbed HCN is very high, even in the case of relatively low concentrations of cyanides. The degree of contamination of the air taken off cooling towers may achieve high values, dangerous for the personnel and the environment. Atomization of effluents can reduce concentrations of cyanides by 50-60%, but will cause a strong atmospheric contamination with HCN.

41278 **APTIC NO. 64200**

Watanabe, Ikuo, Toshiichi Okita, and Shigeru Seino

ANALYSIS OF HYDROCARBONS IN AMBIENT AIR--II--DETERMINATION OF LIGHT HYDROCARBONS IN THE AREA OF PETROLEUM CHEMICAL COMPLEXES. *(Taikichu tanka suiso no bunseki (dainiho)--sekiyu conbinato chiku ni okeru teikyu tanka suiso no bunseki). Text in Japanese. Koshu Eiseiin Kenkyu Hokoku (Bulletin of the Institute of Public Health), 20(2):107-118, 1971. 3 refs.*

Measurements of light hydrocarbons were made in the atmosphere of the Kashima industrial area where petroleum chemical plants were the only sources of HC. A sample gas was taken in a 500 ml gas sampling bottle; 100-200 ml of the gas in the bottle was then condensed in a U-tube filled with glass beads and cooled by liquid oxygen; the gas was then analyzed by gas chromatography. A stainless steel column containing 10% dimethylsulfolane coated on 40/60 mesh of C 22, 30 feet in length and 1/8 inch in diameter, and 10% carbowax 600 coated on 40/60 mesh of C22, 1.5 feet in length and 1/8 inch in diameter, was used. The column temperature was 0 C, and a flame ionization detector was employed. The acetylene and propylene concentrations were high compared with Tokyo. The range of variation of hydrocarbon concentrations over the petroleum chemical plant area was great. Most exhaust gas contained relatively high concentrations of acetylene. Waste water was also one of the light hydrocarbon sources. Concentrations of HC were also measured in the stack gases of various chemical plants.

1970

41279 **APTIC NO. 64075**

Abelitis, Andris

SHAFT FURNACE FOR LIMESTONE USES HOT GAS. *(Schachtofen zur thermischen Behandlung von stueckigem Gut). Text in German. (Kloeckner-Humboldt-Deutz AG, Koeln (Germany)) W. Ger. Pat. Appl. 1,508,482. 5p., March 12, 1970. (5 claims).*

A shaft furnace for the thermal treatment of granular limestone, dolomite, magnesite, or similar materials comprises a surrounding furnace wall containing inlet openings for the hot gas, so that the gas flows transversely to the material towards a central gas extract duct. This gas extract duct extends vertically through the treatment zones from the top feed to the bottom discharge and the wall of the duct is constituted of longitudinal grate bars. The upper part comprises a preheating zone, in which a gas removal pipe is mounted coaxially inside the grating of bars; the gas removed through this pipe is circulated through a blower and so into the preheating zone. The gas enters this pipe from the second stage or high temperature zone below the preheating zone.

41280 **APTIC NO. 63556**

Bailleul, M. R., B. Bapseres, and G. L. Guyot

AIR POLLUTION CONTROL: THIRTEEN YEARS EXPERIENCE AT LACQ. *Preprint, American Inst. of Chemical Engineers, New York, 15p., 1970. (Presented at the American Institite of Chemical Engineers, Annual Meeting, 63rd, Chicago, Ill., Nov. 29-Dec. 3, 1970, Paper 2c.)*

In the Lacq sulfur plant, pollution by sulfur dioxide occurs by units producing sulfur from sour natural gas containing hydrogen sulfide. Since H2S is highly toxic, stack gases are incinerated to transform all sulfur compounds to the less toxic SO2. The yield from sulfur plants varies between 90 and 98%, depending on the H2S content of the acid gas and the size of the plant. The corresponding SO2 concentrations in stack gases vary between 1 and 2.5%. At Lacq they are normally 1.2-1.6%. Several approaches have been studied to treat the tail gas to remove SO2 to yield increase sulfur. These include scrubbing the tail gas with ammonia, adsorbing the H2S on a fixed catalyst bed, and producing sulfuric acid. Another method to produce more sulfur is to improve the yield of the transformation reaction by improving the Claus unit itself. The geographic conditions at Lacq and monthly averages of 24-hour SO2 concentrations measured over the area are discussed. The measurement program and its results are described. From 1961 to 1967, sulfur dioxide emissions increased; between 1967 and 1969 there was a decrease in pollution due to the drastic control methods.

41281 **APTIC NO. 64178**

Hickish, D. E. and K. L. Knight

EXPOSURE TO ASBESTOS DURING BRAKE MAINTENANCE. *Ann. Occupational Hyg., vol. 13:17-21, 1970. 3 refs.*

Air sampling in a car service bay was carried out using membrane filters to determine the emission of asbestos dust during blowing out of brake shoes and drums. Atmosphere samples by car were 1.12, 1.42, and 1.25 fibers/cu cm during the first period, during the second period, and as a time-weighted average, respectively. These values were 1.71, 3.62, and 2.55, respectively for the dust cloud then by the car. An estimate of the daily exposure of the mechanic engaged on brake cleaning was obtained by personal samples. The average concentration was 0.68 fibers/cu cm. During truck servicing, atmospheric concentrations were 0.28 and 0.07 fibers/cu m in the adjacent bay in the morning and afternoon; 0.17 and 0.07 two bays away in the morning and afternoon; and 0.49 and 0.11 in the center of the garage in the morning and afternoon, respectively. Concentrations in personal samples were 7.09 during truck brake cleaning, 0.08 after cleaning, 1.75 time- weighted average for the brake cleaner, 2.25 during clutch-repair in the adjacent bay, 0.11 after cleaning, and 0.79 fibers/cu cm time-weighted average for the person performing clutch repair. The mechanic was exposed to less than the standard of 100 fiber-years/ cu cm during car servicing, although during the actual brake cleaning operation the standard might be exceeded. The standard was not exceeded during brake cleaning in the general atmosphere away from the immediate vicinity of the truck servicing, but personal exposures in the vicinity did exceed the standard. On a daily basis, the personal exposure levels were below the standard, although that of the brake cleaner approached it. In a fleet workshop, brake cleaning operations do not necessarily take place daily. Although brake linings contain 40-60% asbestos, the percentages of fibrous particles in the incinerated samples were 12.3 brake lining material, 1.6 brake drum dust, and 1.3 airborne dust.

41282 **APTIC NO. 64149**

Oden, Svante, Bjorn Berggren, and Anna-Greta Engvall

HEAVY METALS AND CHLORINATED HYDROCARBONS IN SLUDGE. *(Tungmetaller och klorerade kolvaten i rotslam). Text in Swedish. Grundfoerbaettring, 23(5):55-68, 1970. 22 refs.*

Results are presented from sampling the content of heavy metals and chlorinated hydrocarbons in sludge from sewage plants in Sweden. Most of the elements have a log-normal frequency distribution, and the data presented reflect the intensity and type of industrial activity in the different cities. The heavy metals will be enriched in the sewage plants due to high concentration factors, while DDT will be reduced to DDD during the anaerobic fermentation of the sludge. Extensive application of sludge to arable land may lead to toxification of the soil in the long run.

41283 **APTIC NO. 64183**

Potter, Geoffrey, H.

THE INFLUENCE OF ROADS ON THE ENVIRONMENT OF A DENSELY POPULATED COUNTRY. *Preprint, International Road Federation, 46p., 1970. 12 refs. (Presented at the International Road Federation, World Highway Converence 6th, Montreal, Canada, Oct. 1970.)*

The aesthetic design of roads, both urban and rural, and the sociological aspects of road location and design are discussed. Particular emphasis is given to the problems associated with the design and construction of roads in densely populated countries, where the competing demands of many equally important land uses are difficult to resolve. Signs, road furniture, lighting, and their effects on the environment are discussed. Environmental effects include unsightliness of road signs, damage to trees and natural flora and fauna near highways, noise, and air pollution. The main pollutants from gasoline engines are carbon monoxide, lead, nitrogen oxides, aldehydes, and ethylene; the main pollutants from diesel engines are carbon monoxide, smoke small amounts of hydrocarbons, and odor. Although diesels are generally critized more than gasoline engines because of odor and smoke overall they contribute much less pollution than gasoline engines. Large quantities of CO are emitted at idling speeds, and in a study in Paris, there was a definite monthly correlation between traffic intensity and CO concentration. The wind velocity has a considerable influence on the concentration of CO in the open air. Tunnels and underground parking areas with poor ventilation or without mechanical ventilation are subject to extremely high CO concentrations. Standards, regulations, inspections, and various methods to control emissions from vehicles are reviewed. Appendices are given on the preservation of trees during construction work, extracts from British motor vehicle regulations for 1969 on their construction and use concerning air pollution and noise, and a description of the transportation objectives and their measurement for the central Leicestershire structure plan. (Author summary modified)

41284 **APTIC NO. 65888**

National Society for Clean Air, Brighton (England), Technical Committee

AIR POLLUTION FROM ROAD VEHICLES. *44p., 1970 (?). 55 refs.*

By 1970, vehicle traffic will increase threefold. This could cause an increase in pollutant emissions from gasoline and diesel engines unless control methods are developed. The effects of pollutants on health are reviewed, including effects of photochemical smog, hydrocarbons, diesel smoke, oxides of nitrogen, carbon monoxide, and lead. Effects on vegetation, visibility, and property are also mentioned. Various control methods are described including fuel injection, modified carburetors, and diesel engine control methods. Legislative and administrative aspects of pollution control are discussed including regulations under the Road Traffic Act of 1930, international regulations, measurement of smoke density, and the Road Safety Bill. Road vehicle pollution and town planning are also discussed.

1968

41285 **APTIC NO. 64028**

Aliverdiyeva, S. S.

POLLUTION OF THE AIR IN BAKU BY HYDROCARBONS FROM PETROLEUM REFINING AND EXTRACTING INDUSTRIES. *(Zagryaznyennost atmosfernogo vozdykha goroda baky ugelvodorodami ot ob ektov neftepererabatyvayushchey i neftedobyvayushchey promyshlennosti). Tr. Azerb. Nauch.-Issled. Inst. Gig. Tr. Prof. Zabol., p. 183-186, 1968. Translated from Russian. Universal Language Services, Inc., 4p., Sept. 1972.*

NTIS, DDC: AD 771 784

Air pollution in Baku by hydrocarbons from petroleum refining and extracting industries is discussed and a particular refinery was investigated. Sources of pollution include gas, open storage tanks, ditches of oil wastes, and industrial spills. Prevailing winds are unfavorable in the area, as are the normally high temperatures which facilitate evaporation. Lack of proper urban planning is also partly to blame. Air samples were taken at distances of 100, 500, 1000, 2000, and 2500 m from a particular plant. Concentration of pollutants declined in direct proportion to the distance from the source. The concentrations at various distances in 93.8% of the tests exceeded the permissible level for air by tens of times. Studies of air samples taken from residential and business areas located in the district showed that the quantity of hydrocarbons varied from 30.0 mg/cu m to 117.0 mg/cu m, which is close to the levels found at a distance of 100 m from the source of pollution. (Author abstract modified)

1964

41286 **APTIC NO. 63639**

Bourelly, T.

PRELIMINARY RESULTS OF A SURVEY. AIR POLLUTION CAUSED BY DEFECTIVE CHIMNEYS. *(Premiers resultats d enquete. La pollution atmospherique causee par les conduits de fumee defectueux). Text in French. Cahier Centre Sci. Tech. Batiment, no. 67:1-16, April 1964.*

The effects of defective chimneys on air pollution are described on the basis of systematic chimney inspections in Paris. High air-excess coefficients in the combustion chamber lead to the formation of soot due to reduced tmperature, while low air-excess results in solid, liquid and gaseous unburned emissions. The rate of sulfur dioxide-sulfur trioxide conversion is elevated in both cases. The SO3 concentration may also increase during the passage of the flue gas through the chimney at certain temperatures. Chimney leaks as a cause of temperature drop in the chimney were observed in many cases. Lowering of the flue gas temperature can be also caused by ineffective thermal insulation, large chimney cross section, or the use of a metal tube on top of the chimney. Since the repair and correction of defective chimneys is rather expensive, careful chimney cleaning twice a year is recommended as a measure to abate air emissions as caused by such chimney defects.

1958

41287 **APTIC NO. 63524**

CITIES REPORT ON DEMOLITION REFUSE PROBLEM. *Pub. Works Engrs. Newsl., 25(11):1-2, 8-9, Nov. 1958.*

The wastes resulting from the demolition of old structures can be disposed of in several ways, some of which may cause further pollution such as air pollution. Some materials, can be salvaged for reuse or fill material. The combustible portion of the wastes can be burned, but open burning could cause air pollution. Landfilling is another alternative, but is not satisfactory baucause of the poor compaction characteristics of the material. Hauling of wastes for burning or disposal by landfill is expensive because of the light pay-loads. In August 1958, a survey was made to determine the extent of the demolition refuse problem in American cities. The results of the survey are summarized. Forty-eight percent of the responding cities respresenting 70% of the population considered the problem important. The most popular method of disposal was a comination of off-site burning and landfill (42% of the cities used this method). In descending order of reported use, the other methods were landfill (31%), off-site burning (27%), open dump (27%), and on-site burning (14%). Regulations prohibiting burning at the demolition site were in effect in 94% of the cities. Many of the cities commented that air pollution is becoming an increasing problem and is considered during refuse disposal.

1957

41288 **APTIC NO. 64031**

CYCLONE REACTOR GOES ORE - OUT COMES STEEL. *Chem. Week, 80(4):94-96, Jan. 26, 1957.*

A British-developed Cyclosteel process is described which bypasses the coke oven, blast furnace and open-hearth, electric furnace, or Bessemer converter. The process combines the features of two other European developments: the Swedish sponge-iron process and the Austrian top-blowing procedure. The sponge-iron process uses carbon monoxide to reduce the iron ore at temperatures under 1000 C to finely divided particles of iron, though it cannot make low-carbon steel because impurities cannot be separated out. Top blowing allows for separation; by enriching the air with oxygen (or by using pure oxygen diluted with steam or carbon dioxide), temperature and time may be controlled to suit the raw materials and end products. Nitrogen content of the steel, moreover, is reduced to a very low level, and scrap steel can be used as feed. Gases leaving a fluidized preheater are cycloned to separate entrained particles and may then be re-introduced into the process as carrier gas for the powdered ore and fuel. Gases flowing up from the burning zone are supplied with additional oxygen in the reactor s reduction zone, causing further combustion which decreases the calorific value of the exit gases, increases the process s thermal efficiency, and decreases the reducing power of the gases which can be used for preheating the ore.

CONTROL METHODS

1974

41289 **APTIC NO. 64408**

Abe, Kisao, Akira Takahashi, and Takashi Watanabe

TRIAL OPERATION OF CUPOLA FOR DECREASING THE DUST BY FIRING FLUID FUEL. *(Kyupora ryutai nenryo heiyo ni yoru baijin teigen sogyo no kokoromi). Text in Japanese. Imono (Foundry), 46(4):78-79, April 1974. 1 ref.*

Experiments were conducted to reduce the dust emission from cupolas. A small scale model of 220 mm diameter opening was used and the relationship between the combustion speed and the amount of dust was examined. Measurements of dust were made by the Japanese Industrial Standard filter dust tube installed in the upper part of the flue. There was no suction of secondary air, and the dusts were created strictly by the air from the tuyere. There was a clear and close connection between the amount of dusts and the combustion speed; the faster the combustion, the higher the dust rate. But the combustion speed was approximately proportional to the amount of air supply, and the combustion speed lower than 20 kg/hr would impair the cupola operation. To supply additional heat energy, a gas burner was introduced about 400 mm above the tuyere. This succeeded in reducing the amount of dusts. When the melting layer surface temperature was over 1200 C, the coke formed a viscous surface and captured the dusts blown up from the lower part and reduced dusts drastically. Based on these experiments, a combined use of coke and oil was tried, and the amount of dusts was successfully reduced. When the ratio of coke was about 10% and oil 10 to 14.7 l/hr, the dust concentration was reduced to 0.48-1.17 g/N cu m, and was 1/2 to 1/3 of the normal coke operation.

41290 **APTIC NO. 63672**

Abels, Theodor

GAS DRIVE FOR FORK LIFTS FROM THE VIEWPOINT OF THE MANUFACTURER. *(Der Treibgasantrieb fuer Gabelstapler aus der Sicht des Herstellers). Text in German. VDI Ver. Deut. Ingr. Z. (Duesseldorf), 116(8):651-656, June 1974. 10 refs.*

Fork lifts are nowadays primarily equipped with diesel of electric drives, the disadvantages of which, such as odors by diesel exhaust gases and the temporal limitation of the operation of electric batteries, cannot always be tolerated. California test cycles with a Ford otto engine V6(2.61) operated with gas yielded following results: engine power 44.6 HP (32.8kW) at 2300 rpm; carbon monoxide concentration 3.659 g/HPh (about 5 g/kWh, i.e., about one seventh of the maximum allowable concentration from 1977 on as measured by the California test); and oxides of nitrogen and hydrocarbons 6.75 g/HPh (about 9 g/kWh). However, since the conditions indoors, where fork lifts are mostly used, are different than outdoors, the emissions by gas driven fork lifts are compared with the maximum allowed working place concentrations for the various exhaust gas pollutants and with the emissions by diesel operated fork lifts.

41291 **APTIC NO. 64351**

Araki, Kunio, Shigeji Honda, and Kohei Takano

ODOR REMOVAL APPARATUS BY CATALYTIC OXIDATION DECOMPOSITION. *(Sesshoku sanka bunkaiho ni yoru akushu jokyo sochi). Text in Japanese. Hokkaidoritsu Kogyo Shikenjo Hokoku (Rep. Hokkaido Ind. Prefect. Exp. Stn.), no. 223:2-10, March 1974. 1 ref.*

The catalytic oxidation decomposition method was successfully applied to the removal of malodor from fish meal plants. The main advantage of this method is the lower fuel cost, since the decomposition takes place at 250-350 C compared to 800 C required by the combustion method. A zeolite prepared by pulverizing and molding into spherical form was used as the catalyst. The chemical and physical properties of catalyst tested are given. A schematic diagram of the odor removal apparatus consisting of drying unit, washing tower, blower, and deodorization tower containing the catalyst and a flow sheet of the process are also given. The odor adsorbed on the catalyst is decomposed at 300 C by catalytic oxidation. This method is very effective for the removal of hydrogen sulfide, organic acids, and mercaptans; however, it is unsatisfactory for the removal of ammonium compounds. The prior removal of ammonium and amine compounds by washing is essential. The actual process of deodorization of exhaust gas from fish meal plant is described. The pollutant concentrations in exhaust gas from the drying furnace and deodorization tower are reduced from 154.17-0.01 ppm NH_3, 95.61-0.00 ppm nitrogen from amines, 1.94-0.01 ppm sulfhydryl compounds, and 0.93-0.03 ppm hydrogen sulfide.

41292 **APTIC NO. 64398**

Axeborg, Tord Valter Yngve

METHODS OF REMOVING SULFUR FROM THE EXHAUST GASES OF FIRED FUELS CONTAINING SULFUR AND OF SIMULTANEOUSLY EXPLOITING THE SULFUR FOR THE PREPARATION OF SULFURIC ACID. *(Assignee not given.) U. S. Pat. 3,786,136. 2p., Jan. 15, 1974. 5 refs. (Appl. July 15, 1971, 8 claims).*

A method for removing sulfur from the exhaust gases of fired fuels and for simultaneously using the S in the preparation of sulfuric acid is described. Inexpensive, thick oil of high S content is extensively used and the discharge from the chimneys of sulfur dioxide and S carbon black forming at combustion causes environmental damage and is a risk to human health. The S can almost be completely removed if ammonium nitrate and at least one of the compounds potassium nitrate and sodium nitrate are introduced into the exhaust gases. The exhaust gases are mixed with steam in a reaction chamber to cool the exhaust gases and to collect the H_2O_4 solution. The nitrates provide a large oxygen excess and almost 100% combustion is attained.

41293 **APTIC NO. 63720**

Azuma, Kenkoku, Kunihiro Doi, Masahiro Morikawa, and Motohiro Kose

DEODORIZATION WITH OZONE. *(Ozon ni yoru akushu shori). Text in Japanese. Mitsubishi Denki Giho (Tokyo), 48(4):431-437, April 1974. 11 refs.*

Deodorizers with ozone are extensively used for the treatment of bad odors from sewage and urine disposal plants. Studies are continuing on applying them for the treatment of exhaust gas and waste water from kraft pulp factories and marine product processing plants. Deodorization theory is described. Examples of successful deodorization of gases and water with ozone are discussed. Cases of similar treatment are described for the exhaust from food processing plants. A possibility for accelerating the reactions on the surface of activated carbon with ozone is described for the case of mercaptan and hydrogen sulfide in which the gas phase oxidation with ozone is not fast enough. A trial manufacture of a deodorizing apparatus consisting of a scrubber with ozone dissolved in water as an absorbent and an activated carbon bed is discussed. The apparatus has proved successful in experiments, however further improvement will be needed for commercial operation.

41294 **APTIC NO. 63879**

Baker, James A. and Edward J. Poziomek

A SURVEY OF TEST METHODS FOR RESIDUAL LIFE OF CHARCOAL FILTERS. *Mater. Eval., 32(5):35A-39A, May 1974. 13 refs.*

Nondestructive test methods for determining residual life of air filters containing charcoal are discussed. The methodology is documented primarily in terms of vapor pulse or wavefront techniques. The vapor pulse technique involves testing a bed with a challenge gas which can be monitored accurately in the effluent. In order to test the bed, nondestructively, the test gas must be adsorbed poorly and desorbed easily. The use of carbon dioxide as a weak chemisorbate has been studied several times. In order to determine the CO2 residual life, three measurements on identical beds under identical conditions are necessary. Freon-12 (dichlorodifluoromethane) and Freon-112 (1,1,2,2- tetrachloro-1,2-difluoroethane) have also been used in nondestructive tests of adsorbent beds. The wavefront technique consists of determining the progress of an adsorbate through a filter bed. Scanning a charcoal bed normal to the direction of air flow with a series of beta adsorption radiographic measurements was examined as a way of determining the amount and distribution of the adsorbate. Thermal analysis of adsorption effects and studies of changes in the relative electrical resistance of a filter as adsorption/desorption occurs have also been used as wavefront tests. Other measurement methods which could not be fitted conveniently under the vapor pulse or wavefront category include water displacement, canister plug, weight changes, reduction ratio method, and carbon monoxide.

41295 **APTIC NO. 65916**

Barber, Gordon

LAND RECLAMATION AND ENVIRONMENTAL BENEFITS OF ASH UTILIZATION. *Bureau of Mines Information Circ., no. 8640:246-257, 1974. (Presented at the International Ash Utilization Symposium, 3rd, Pittsburgh, Pa., March 13-14, 1973.)*

Although more than half the total amount of pulverized fly ash (PFA) produced by the Central Electricity Generating Board in England is utilized commercially, this still leaves some 3.8 million tons annually available for land reclamation purposes. The Generating Board has, therefore, a considerable interest in the amenity problems associated with ash disposal. Types of reclamation and cultivation procedures are discussed. Most large disposal systems involve the ash being either slurried and pumped to a settling lagoon or conditioned, moistened and transported to a disposal site. When fly ash is used for land reclamation, a surface is produced which needs some form of protection such as plant growth. Several mosses have been tested as surface coverings. Lagoons dry out when filled and can become a potential dust hazard before any form of vegetation is established. Floater fly ash or conditioned ash may be used as a treatment. Pulverized fly ash needs protection from blowing which can be accomplished by water, emulsion, or polymer sprays. Research on ash as a primitive soil is discussed. Cultivation procedures, establishment of a grass cover, and ability of PFA to support various trees and shrubs are discussed.

41296 **APTIC NO. 65911**

Barenberg, Ernest J.

UTILIZATION OF ASH IN STABILIZED BASE CONSTRUCTION. *Bureau of Mines Information Circ., no. 8640:180-196, 1974. 16 refs. (Presented at the International Ash Utilization Symposium, 3rd, Pittsburgh, Pa., March 13-14, 1973.)*

Fly ash can be used as a base and subbase construction material for road and airfield pavements. The properties of lime-fly ash-aggregate (LFA) and lime-cement-fly ash-aggregate (LCFA) mixtures are reviewed as they relate to pavement behavior and performance. While these materials are probably the easiest of all paving materials to work with during construction, inadequate attention to proper preparation of the subgrade or to the quality control during mixing, placing, or compaction can lead to substandard materials and a concomitant early distress in the pavement. The LFA and LCFA mixtures have the potential to be high-quality paving materials. The application and marketing of these materials have not been exploited to the fullest extent. With additional effort on a national level, this market could be developed to utilize a substantial portion of all fly ash produced. Engineering properties of LFA mixtures are described including the two most important properties of durability and dimensional stability. Compressive strength, flexural strength, stiffness, autogeneous healing, and fatigue properties are also reviewed. Factors influencing engineering properties and performance and pavement behavior and performance are discussed. (Author conclusions modified)

41297 **APTIC NO. 65783**

Barrett, D.

REMOVAL OF SULPHUR FROM FLUE GASES. *Aust. Chem. Eng., 15(3):5-10, March 1974. 8 refs.*

Processes for the removal of sulfur from flue gases are described. Parameters for a successful desulfurization process are a regenerable process; short reaction time; moderate pressure drop; trouble free system; and high efficiency. Various reactions were explored over a temperature range from 700 C down to ambient including conversion of sulfur dioxide to sulfur trioxide and sulfuric acid, high temperature chemical reaction and dry absorption, and low temperature reaction and scrubbing. Attempts are being made to remove sulfur under reducing conditions. The scheme envisages twin fluidized beds. In the first bed partial combustion (gasification) is carried out in a lime containing fluidized bed. The process appears to fix the organic impurities and avoid problems due to sodium and vanadium. The weakness of the process is the low efficiency of the lime utilization.

41298 **APTIC NO. 63660**

Baum, H. E.

ODOR BINDING IN SEWAGE PURIFICATION PLANTS. *(Geruchsbindung bei Klaeranlagen). Text in German. Gesundheitstech., 8(5):109-110, 1974.*

Spherical balls of 24, 45 and 150 mm diameter made of polypropylene were found to bind odors in sewage purification plants if spread densely over the water surface. A dense layer of spherical balls covers 91% of the effluent surface. The remaining 9% consists of small air pockets which prevent any evaporation. The reduction of evaporation reduces the heat demand. A reduced evaporation means also less odor emissions. Tests in the laboratory with the balls, which have the name Allplas and which are also available with a diameter of 45 mm in which case they are made of high pressure polyethylene containing 2.5% soot, have shown that the odor of a hydrogen sulfide solution can be reduced by 98.2% with a single layer, by 98.65% with a double layer, and by 98.8% with a triple layer. The balls can be used for effluents with a solids contents of up to 7%. They can be easily collected from the surface by a net and cleaned with a water jet.

41299 **APTIC NO. 63538**

Beavon, David K. and Ray N. Fleck

SULFUR REMOVAL FROM CLAUS PLANT TAIL GAS WITH BEAVON SULFUR REMOVAL PROCESS. *Preprint, American Chemical Society, Washington, D. C., 12p., 1974. 10 refs. (Presented at the American Chemical Society Annual Spring Meeting, Los Angeles, Calif., April 1974.)*

The design, operation, and economics of the Beavon sulfur removal process are described. The process is designed to clean Claus plant tail gas by first catalytically hydrolyzing and/or hydrogenating sulfur contaminants such as sulfur dioxide to hydrogen sulfide and then converting the H2S to elemental sulfur for recovery in a Stretford process unit. Commercial plants can reduce the concentration of sulfur compounds (as H2S) in the tail gas from 1-3 volume percent to less than 1000 ppm, with the treated gas containing less than 1 ppm of H2S. Capital investment for a Beavon plant to process tail gas from a 100-long-ton-per-day Claus unit is about $1,250,000. A breakdown of operating costs is also given.

41300 **APTIC NO. 63653**

Bernert, Juergen

GAS EMISSION. *(Gas-Emission). Text in German. VDI Ver. Deut. Ing. Z. (Duesseldorf), 116(9):725-728, June 1974. 38 refs.*

Examinations of the odorous emissions of eleven food producing and animal breeding plants revealed that thermal afterburning of waste gases from a meat smoking plant and condensation of the vapors from a beer brewery and pommes frites frying plant gave relatively good results, whereas electrostatic precipitators in a meat smoking plant and ozone treatment of waste gases from pig and poultry breeding stations turned out to be inefficient. Ventilation of stys, optimum manure removal, and storage and flushing are recommended instead of waste gas cleaning. A review of papers dealing with inorganic gas emissions, the dispersion of polluting gases in the atmosphere and the measurement of gas emissions is given.

41301 **APTIC NO. 64309**

Bernstein, Robert Jack

A ROTARY PISTON INTERNAL COMBUSTION ENGINE. *(Assignee not given.) Brit. Pat. 1,354,170. 6p., May 22, 1974. (Appl. Aug. 31, 1971, 3 claims).*

A rotary piston internal combustion engine is described which develops more power at low speeds than other rotary engines, provides low vibration, and minimizes the production of exhaust emissions due to the fact that exhaust gases are not discharged until the next rotation of the rotary piston, allowing for cooling to a temperature which is low enough to reduce the formation of smog components. The engine uses a two-lobe combustion chamber, with an oscillatory piston being positioned in one lobe and a rotary piston being positioned in another lobe and with an exhaust chamber also being formed by the rotary piston. The expanding gases of the ignition of a combustible mixture in the first lobe first drive the oscillatory piston, which drives the rotary piston by a cam action. The expanding gases then drive the rotary piston directly which forces exhaust gases from the previous explosion from an exhaust chamber. The rotary piston then drives the oscillatory piston by means of a cam action to compress a new charge of the combustible mixture that has been introduced into the first lobe of the combustion chamber.

41302 **APTIC NO. 63443**

Bietry, J.

ENERGY - A SOURCE OF WELL BEING AND OF AIR POLLUTION. *(Energie - eine Quelle des Wohlbefindens wie auch der Luftverschmutzung). Text in German. Chem. Rundschau (Solothurn), 27(18):17, May 1974.*

General problems of the use and generation of energy and related air pollution are discussed with regard to the situation in Switzerland. While electricity in itself causes no air pollution during its use, its generation, except in hydroelectric and nuclear power plants, is associated with considerable pollutant emissions particularly in the form of sulfur dioxide and particulate matter. To abate energy generation-related air pollution, and to preclude energy shortages in the future, thrifty use of both electricity and fuel will be necessary. Improved thermal insulation in buildings, fuel desulfurization, improved combustion equipment and chimney design, and the use of remote heating systems will further abate air pollution generated by combustion processes.

41303 **APTIC NO. 65913**

Blocker, W. V., R. E. Morrison, W. E. Morton, and W. A. Babcock

MARKETING POWERPLANT AGGREGATES AS A ROAD BASE MATERIAL. *Bureau of Mines Information Circ., no. 8640:208-223, 1974. 8 refs. (Presented at the International Ash Utilization Symposium, Pittsburgh, Pa., March 13-14, 1973.)*

The characteristics of ashes from powerplants are discussed, including those of fly ash, boiler slag, and dry and wet bottom ash. Applications for the by-product material are reviewed. Fly ash and powerplant aggregate (PPA) are marketable products. Their recovery and reuse can aid in reducing pollution, reduce disposal problems, and provide a supply of material for road and other construction material. The marketing and availability of this material are discussed. Several projects using fly ash and PPA in asphalt and road construction are reviewed.

41304 **APTIC NO. 65822**

Bodle, William W. and Kirit C. Vyas

CLEAN FUELS FROM COAL. *Oil. Gas J., 72(34):73-80, Aug. 26, 1974. 3 refs.*

Flow diagrams and descriptions are presented for clean fuels from coal processes such as liquefaction and gasification. Each includes references for additional information and the current status of technological development. The processes are: Atgas (Applied Technology Corp.); Bi-Gas (Bituminous Coal Research Inc.,) Carbon Dioxide Acceptor (Consolidation Coal Co.); COED (FMC Corp.); Fischer-Tropsch (M. W. Kellogg Co. and Arge- Arbeit Germeinschaft Lurgi and Ruhrchemie): Consol Synthetic Fuel (Consolidation Coal Co.); Garrett s Coal Pyrolysis (Garrett Research and Development Co., Inc.); H-Coal (Hydrocarbon Research Inc.); Hydrane (Bureau of Mines); and Lurgi (Lurgi Mineraloltechnik Gmbh). These are representative of the three ways to obtain clean fuels: conversion or synthesis to methanol or to hydrocarbon oil; pyrolysis; and dissolving the coal in a solvent and treating the solvent with hydrogen.

41305 **APTIC NO. 64097**

Bouffard, R. A. and W. E. Waddey

LUBE EFFECTS ON EXHAUST GAS OXIDATION CATALYST ACTIVITY. *Preprint, Society of Automotive Engineers, New York, 8p., 1974. 11 refs. (Presented at the Society of Automotive Engineers, Automotive Engineering Congress, Detroit, Mich., Feb. 25-March 1, 1974, Paper 740135.)*

The effects of American Petroleum Institute SE engine oils on the activity of a 1975 prototype monolithic, noble metal oxidation catalyst were studied in long-term multicylinder laboratory engine tests. Oil consumption rates up to 1 qt/1000 mi and lube ash up to 1.6% did not significantly affect catalyst activity in 500 hr tests, equivalent to 20,000 mi. A commercial type 1% ash SE oil showed only a small effect on catalyst activity in an extended 1250 hr test, equivalent to 50,000 mi. At the end of the test, the catalyst met the original 1975 emission standards of 3.4 g/mi carbon monoxide and 0.41 g/mi hydrocarbons. A higher-than-normal phosphorus-containing oil (0.32% P) caused significant loss in catalyst activity after testing for 30,000 mi. This suggested that any need for increased phosphorus-containing additivies in future oils could cause catalyst poisoning before 50,000 mi. Although the laboratory test showed compatibility of SE oils with oxidation catalysts on 1975 cars, actual service will provide a more severe test of lube effects on catalyst life and durability. (Author abstract modified)

41306 **APTIC NO. 65896**

Brackett, C. E.

PRODUCTION AND UTILIZATION OF ASH IN THE UNITED STATES. *Bureau of Mines Information Circ., no. 8640:12-18, 1974. (Presented at the International Ash Utilization Symposium, 3rd, Pittsburgh, Pa., March 13-14, 1973.)*

The production and use of fly ash from coal-burning power plants is reviewed. The large increases in ash production from 1970 to 1971 were due to rapid degradation in the quality of the coal used, conversion of utilities from coal to oil, increased use of lignite coal, and installation of ash collectors and use of firing systems which allow higher ash collection efficiencies than those used in the past. Future increased use of sulfur dioxide scrubbers without electrostatic precipitation will reduce fly ash production and change its composition. Estimated fly ash, bottom ash, and boiler slag utilization in 1971 were 1,380,748, 1,069,131, and 3,356,713 tons, respectively. The respective values for ash production in 1976 are 36,994,436, 117,411,603, and 2,517,703 tons. Ash can be used in manufacturing cement, mine fire control, roads, blocks, fill material, soil conditioner, airport pavement, fertilizer filler, rubber filler, vanadium recovery material, dust control material, and asphalt. Trends in fly ash, bottom ash, and boiler slag utilization from 1966 to 1971 are discussed. Recent developments in ash utilization are discussed. Although progress has been made, until 70-80% of the ash is utilized, more work will be needed.

41307 **APTIC NO. 65912**

Brink, Russell H.

USE OF WASTE SULFATE ON TRANSPO 72 PARKING LOT. *Bureau of Mines Information Circ., no. 8640:197-207, 1974. (Presented at the International Ash Utilization Symposium, 3rd, Pittsburgh, Pa., March 13-14, 1973.)*

A project to recycle calcium sulfate, a by-product from scrubbing of sulfur dioxide, into a material to pave parking lots is described. A mixture of calcium sulfate, lime, and fly ash which is more stable than a straight lime-fly ash mixture was used to build a parking lot at Transpo 72, the International Transportation Exposition. The materials used to make the paving mixture, the paving compositions, synthetic aggregate compositions, and performance of the parking lot are discussed. The lot demonstrated that mixtures of lime, sulfate, fly ash, and aggregate are useful for base course construction. Such mixtures must be properly compacted, sealed against the loss or gain of moisture, and covered with a wearing surface. The feasibility of producing aggregate particles from a mixture of lime, sulfate, and fly ash was also demonstrated. The effect of aggregate chemical composition on structure of the aggregate is discussed.

41308 **APTIC NO. 63767**

Brocke, W. and P. Davids

STATE OF THE ART OF FLUE GAS DESULFURIZATION IN POWER PLANTS ON AN INTERNATIONAL LEVEL. *(Internationaler Stand der Technik der Abgasentschwefelung). Text in German. Brennstoff-Waerme-Kraft, 26(3):102-108, March 1974. 29 refs.*

Flue gas desulfurization processes and equipment currently used or being planned for thermal power plants firing coal or fuel oil in the USA, Japan, and Sweden are surveyed. Full-scale flue gas desulfurization was used in over 50 power plants of the world as of late 1973. Apart from initial difficulties especially with the calcia and limestone processes, flue gas desulfurization equipment is reliable and efficient in the removal of sulfur dioxide, and the end products, such as sulfuric acid, elemental sulfur, or calcium sulfate are vaporized in many cases. Scrubbing with calcia, calcium hydroxide, or limestone is applied currently in 23 power plants. Venturi scrubbers are commonly used as wet separators in the limestone and calcia processes. The sodium-based and magnesia processes supply sulfite and sulfates in the scrubber that are then regenerated thermally, and the concentrated SO2 is recovered. In the Chiyoda process, dedusted flue gas is contacted with dilute sulfuric acid for the absorption and oxidation of SO2 to sulfuric acid. This process has an efficiency amounting to at least 90%. It is also possible to oxidize SO2 by a vanadium pentoxide catalyst at 450 C to obtain sulfuric acid in a second step, or SO2 can be adsorbed on activated carbon for subsequent conversion to sulfuric acid.

41309 **APTIC NO. 63676**

Broich, Franz

PROGRESS OF CHEMICAL ENGINEERING. *(Fortschritte der Chemietechnik). Text in German. Chem. Ind. (Duesseldorf), 26(7):415-419, July 1974. 30 refs.*

Many new processes for removal of sulfur dioxide from flue gas have been developed, including wet and dry processes. As an example of a wet desulfurization process the Bischoff process is briefly reviewed. With dry desulfurization processes finely pulverized calcium oxide or NaHCO3 are injected and the sulfite separated in filters. For the removal of sulfur from fuels hydration processes have been further developed. For decontamination of automobile exhausts catalytic afterburners have been developed, which operate quite successfully. Unfortunately, the leaded gasolines shorten the life-time of the catalysts.

41310 **APTIC NO. 63699**

Budnik, N. M., R. M. Khazan, V. A. Prikhod ko, L. Y. Ioffe, Y. P. Mikhaylov, I. P. Mukhlenov, E. Y. Tarat, and A. Tubolkin

EQUIPMENT FOR THE RECOVERY OF CARBON DIOXIDE FROM FLUE GASES. *(Ustanovka dlya polucheniya uglekisloty iz dymovykh gazov). Text in Russian. Svar. Proizvod., no. 4:50, 1974.*

The possibility of the recovery and use of carbon dioxide as a component of the flue gas in industrial boilers for welding and steel smelting operations, and a compact equipment with a daily capacity of 5 tons for CO2 recovery are described. Depending on the type of the fuel used, flue gases from industrial boilers contain from 5 to 16% CO2. The CO2 recovered by means of this equipment is 4 to 5 times cheaper than bottled gas.

41311 **APTIC NO. 64403**

Burstein, Norman and Richard D. Ditzler

SMOKE ELIMINATING DEVICE. *(Smokontrol Corp. of America, Pennsauken, N. J.) U. S. Pat. 3,785,778. 7p., Jan. 15, 1974. 15 refs. (Appl. March 2[illegible] 1971, 13 claims).*

An improved smoke or vapor control device for eliminating combustible, carbon containing vapors or smoke is described. The device has an inlet hood capable of collecting smoke from a broiler or other cooker. In a passageway between an outlet and the hood is a cellular, oxidation catalyst-coated refractory block threaded with high resistance electrical wire for heating the block cells. An impeller associated with the passageway draws the vapors through the heated block cells for combustion of the vapors and then forces them on through the outlet. Other smoke control devices are either expensive, inefficient, or otherwise limited in use, due to the costly precious metal catalysts and to difficulties and complications in elevating the temperature of the contaminating vapors to that required for effective catalytic oxidation. (Author abstract modified)

41312 **APTIC NO. 63679**

Bussmann, Bernhard

DESULPHURIZATION OF COKE OVEN GAS WITH THE AID OF AMMONIA AND PRODUCTION OF SULPHURIC ACID WITH SIMULTANEOUS AMMONIA DESTRUCTION. *(Entschwefelung des Koksofengases mit Ammoniak und Schwefelsaeureerzeugung* *unter gleichzeitiger Ammoniakvernichtung). Text in German. Stahl. Eisen (Duesseldorf), 94(14):627-631, July 1974. 4 refs.*

The removal of hydrogen sulfide from coke oven stack gases by using the ammonia contained in the gases has proved successful. The H2S can be lowered by 85 to 90%. The ammonia is burnt and the H2S removed by scrubbing is further processed to sulfuric acid. The August Thyssen coke oven plant in Duisburg is described. The throughput capacity is 120,000 cu m/hr and the sulfuric acid production amounts to 70 tons/day.

41313 **APTIC NO. 64400**

Camarasa, Mario and Bernhard Josef Kraus

PURIFICATION OF INTERNAL COMBUSTION ENGINE EXHAUST GAS. *(Esso Research Engineering Co., Linden, N. J.) U. S. Pat. 3,788,070. 9p., Jan. 29, 1974. 5 refs. (Appl. June 12, 1972, 13 claims).*

A thermal reactor for mitigating or eliminating pollutants in automotive exhaust gas is described. Cool air is supplied to the annular space formed between the reaction chamber and an outer sleeve. The chamber wall is formed with longitudinal slots which are inclined relative to their respective radii from the center of the chamber so that air enters the chamber from the annulus and some circulates generally around the interior wall of the chamber to protect it from high interior temperatures. The inclination of the walls is an improvement over other reactors which require large and expensive materials to avoid thermal damage. The exhaust gas is passed to one end of the chamber from exhaust conduits which are inclined in the same sense as the longitudinal slots and at roughly the same angle so that vortex circulation of exhaust gas and air is promoted in the chamber. The exhaust gas/air mixture reacts in the chamber and purified gas passes out of the chamber at the center of the opposite end. (Author abstract modified)

41314 **APTIC NO. 63880**

Cameron, L. C.

AQUITAINE IMPROVES SULFREEN PROCESS FOR MORE H2S RECOVERY. *Oil Gas J., 72(25):110-112, 117-120, June 24, 1974. 1 ref. (Presented at the GPA Annual Meeting, Denver, Colo., March 25-27, 1974.)*

The Sulfreen process for reducing the sulfur in tail gas from Claus sulfur plants is improved, including the use of a new alumina catalyst. The process now features: overall recovery up to a minimum of 99% for dilute Claus gas streams based on performance in major industrial installations; low capital, operating, and maintenance costs; simple operation similar to Claus plant, using commonly available catalyst at normal operating temperatures and pressures; conventional construction materials; and no liquid or other waste-disposal. Improvements were the result of developmental studies in the laboratory, bench-scale testing, and application in a large French plant. A side advantage of the alumina Sulfreen unit is the opportunity for improving Claus sulfur-plant operations. A technique was developed which is used automatically during every regeneration to prevent sulfate formation, effectively reducing catalyst aging and maintaining the high activity and conversion efficiency. Minimum guaranteed conversions of H2S + sulfur dioxide to sulfur depends on the total H2S + SO2 concentration in the tail gas. The Sulfreen process probably recovers all the free sulfur present in the form of vapor or entrained droplets, providing tail-gas temperature does not exceed 280 F. A two-stage Sulfreen process for conversions beyond 99.5% has the tail gas desulfurized in two steps. It has been tested in bench scale and will soon be available for industrial application.

41315 **APTIC NO. 65790**

Campbell, K.

KEEPING LEAD IN THE CAR. *J. Automotive Eng., 5(3):9-14, June 1974. 14 refs.*

The reduction of vehicle lead emissions by a filtration system is discussed. The system involves replacing the normal sound absorbing materials in the resonator and silencer with alumina coated stainless steel wool. Over test period of 40,000 km the filter systems reduced Pb emission by 80% or more. Emissions were reduced by 88% at extended usage distances under city or urban conditions. Not only total Pb but also airborne Pb emissions are significantly reduced throughout the life of the filter. Filtration devices of 70% efficiency for cars of 1.3 l and above cost from 2.2 to 2.4 times more than the standard exhaust. The more efficient devices cost slightly more.

41316 **APTIC NO. 65917**

Capp, John P. and D. W. Gillmore

SOIL MAKING POTENTIAL OF POWERPLANT FLY ASH IN MINED-LAND RECLAMATION. *Bureau of Mines Information Circ., no. 8640:258-268, 1974. 7 refs. (Presented at the International Ash Utilization Symposium, 3rd, Pittsburgh, Pa., March 13-14, 1973.)*

A reclamation procedure is described which enables the reclaimer to utilize the special soil-making characteristics of powerplant fly ash to aid in the restoration of disturbed lands. This procedure would help return waste areas to productive use and help solve the fly ash disposal problem. Now only 20% of the 40,000,000 tons/yr fly ash produced in the U. S. is utilized and the rest is trucked to landfills and dumps. Coal production and estimated land disturbed by surface mining for coal in the U. S. in 1970 are tabulated. Properties of spoil and refuse that restrict plant growth and fly ash properties that improve spoil and refuse are discussed. Fly ash can neutralize pH, depending on its boron, phosphorus, and zinc content. Fly ash also increases the moisture-boiling capacity of spoils. Fly ash reclamation techniques and benefits are described.

41317 **APTIC NO. 64297**

Carlson, Harrison Cornforth and Wayne Thomas Hess

THE SEPARATION OF AMMONIA FROM GAS STREAMS. *(E. I. Du Pont De Nemours and Co., Wilmington, Del.) Brit. Pat. 1,350,490. 5p., April 18, 1974. (Appl. Oct. 26, 1971, 10 claims).*

A process for the recovery of ammonia from mixtures of gases comprising ammonia and hydrogen cyanide is described which overcomes uneconomical conditions associated with prior art devices which require an abnormally high vapor rate (stripping steam) in the ammonia stripping operation. Substantially all of the ammonia and a minor protion of the hydrogen cyanide are absorbed in an aqueous solution of monoammonium and diammonium hydrogen phosphates in an absorbing zone. The resulting solution is passed into a hydrogen cyanide stripping zone in which the hydrogen cyanide and a minor proportion of the absorbed ammonia are removed. The hydrogen cyanide-free solution is passed into a second stripping zone to remove the remaining available ammonia which is collected. The solution removed from the second stripping zone is in two streams such that one stream is leaner in ammonia. Both streams at a temperature between 40 and 70 C are passed to different points of the absorbing zone, with the leaner stream for ammonia being passed into the absorbing zone where most of the ammonia has been absorbed.

41318 **APTIC NO. 65921**

Cascarini de Torre, L. E. and G. E. Fernandez

ADSORPTION OF NITROUS OXIDE ON GRAPHITE. *(La adsorcion de oxido nitroso sobre grafito). Text in Spanish. Anales Quim., 70(4):293-296, April 1974. 16 refs.*

The adsorption of nitrous oxide on spectroscopically pure graphite powder was studied at a temperature range from 192.5 to 273 K and a pressure range from a few cm mercury up to atmospheric pressure. The adsorption was a physical adsorption fitting the Langmuir and B.E.T. models at 192.5 and 227.5 K; it was a dilute absorption at 273 K. There was little difference between the heat of adsorption and the heat of liquefaction in this system. A N_2O molecule was adsorbed for approximately 3.3 benzene rings in the formation of the monolayer.

41319 **APTIC NO. 63773**

Chrucciel, Romuald

POSSIBILITY OF ENVIRONMENTAL PROTECTION BY THE ADDITION OF GASEOUS AMMONIA TO SMOKE. *(L adjonction de gaz ammonia aux fumees aidera-t-elle a proteger l environment)? Text in French. Tech. Pol., no. 1-2:19-24, 1974. 27 refs.*

The effects of ammonium sulfate and ammonia (the products of neutralization of sulfur dioxide in flue gases by gaseous ammonia) on animals, plant growth, surface waters, and soil were studied. The SO_2-containing flue gases, such as those generated in thermal power plants, are neutralized by gaseous ammonia injection which forms ammonium sulfite, and then ammonia sulfate with SO_2. Aerosol formation and crystallization occur below a critical crystallization temperature and at a certain distance from the emission source. Unlike a group of guinea pigs which had inhaled SO_2, another group which had inhaled ammonia-neutralized SO_2 showed practically departure from the physiological albumin, serum sodium, and carbon dioxide partial pressure. Colza and sunflowers, exposed to the neutralization products of SO_2 in the air, were growing more intensely than control plants, due to the fertilization effect of ammonium sulfate. The protective effect of ammonia was evident even during periods of high SO_2 concentrations when only partial neutralization of SO_2 was possible. Flue gas neutralization by means of gaseous ammonia was applied successfully in a large power plant.

41320 **APTIC NO. 63778**

Constantinescu, Piacovschi and Lany Georgescu

OVERVIEW OF INDUSTRIAL WASTE GAS DESULFURIZATION TECHNIQUES. *(Panorama des techniques de desulfuration de gaz industriels). Text in French. Chim.-Actualites, no. 1527:39-43, March 1974.*

Wet and dry processes developed and currently under development for flue gas desulfurization are described. The Wellman-Lord process uses sodium carbonate solution as absorbent, and the sodium disulfite obtained is then converted into concentrated sulfur dioxide and sodium sulfite. In the Jecco process, a calcia suspension is used for absorption, and the calcium sulfite obtained is converted to gypsum. The Mitsubishi process adopts a magnesia suspension, and the resulting magnesium sulfate is converted into sulfuric acid and magnesium chloride by the addition of hydrochloric acid. Hydrogen sulfide and SO_2 from the Claus process are converted into elemental sulfur in the Sulfreen Lurgi-SNPA process. The Grillo process is characterized by the use of a mixture of manganese dioxide and magnesium hydroxide deposited on coke. Ammonium sulfate and concentrated SO_2 can be obtained by SO_2 absorption in ammoniacal solution. Dry processes use powdered calcium carbonate, alkalized alumina coke, or semicoke as adsorbents for SO_2 in or after the flue gas duct. The Kiyoura process uses a vanadium-based catalyst for the oxidation of SO_2 to sulfur trioxide for subsequent conversion to ammonium sulfate with ammonia.

41321 **APTIC NO. 63545**

Crook, James O.

FUGITIVE DUST CONTROL. *Pit Quarry, 66(12):67-68, 106-107, June 1974. (Presented at the National Crushed Stone Association Annual Convention, 57th, McCormick Place, Chicago, Ill.)*

Causes and controls of fugitive dusts are reviewed for the quarrying industry. Major causes and contributing factors of fugitive dusts include: weather elements such as wind velocity and direction, precipitation, and moisture; quarry operations such as drilling, blasting, loading, haul units and roads, and stockpiles; non-vegetated or bare areas; and land configuration both in and surrounding plant stockpile areas. Control measures include: water spraying, scheduling blasting during periods of either low wind or the correct wind direction, the use of stone ladders (enclosed towers) to eliminate the long free-fall of stone, the mixing of sand and water in a small pug mill, the use of stacker conveyors which can be raised or lowered just above the pile, and proper location of stockpiles.

41322 **APTIC NO. 63743**

Danjo, Akio, Teruo Sawada, and Ryo Nishi

STUDIES ON POLLUTANTS EMITTED BY GAS TURBINES AND CONTROL METHODS. PART 2. STUDIES OF EMISSION GASES BY FUEL TYPES. *(Gasu tabin yori haishutsu sareru osen busshitsu to sono togyoni kansuru kenkyu. Dainiho: Nenryo no chigai ni yoru haigasu chosa). Text in Japanese. Preprint, Japan Society of Mechanical Engineers, Kansai, p. 51-53, March 1974. 4 refs. (Presented at the Japan Society of Mechanical Engineers, Kansai Branch Meeting, 49th, Higashiosaka, Japan, March 19-20, 1974. Paper 3405.)*

The concentrations of carbon monoxide, total hydrocarbons (THC), nitrogen oxides (NOx and nitric oxide and aldehydes contained in exhaust gas from a small-sized gas turbine using isopropyl alcohol as fuel were measured at various operating modes and compared with the use of kerosene. The operating data of turbine type, rotational frequency, compressor outlet pressure and temperature, turbine inlet temperature, fuel flow rate, air flow rate, and fuel air ratio are given. The CO and THC concentrations remained almost unchanged in the range of idle to 30,000 rpm in both cases. The concentration of initially formed NO in the case of C_3H_8O was reduced by about 29% at idle and about 47% at 30,000 rpm compared to those of kerosene. The conversion rates of NO to nitrogen dioxide were approximately equal in both cases within the range of this study. However, the conversion mechanism of NO to NO_2 is not clarified. The aldehydes produced are formaldehyde and acrolein, and the ratio can be expressed by total aldehyde equals CH_2O + (0.29 times C_3H_4O). The concentration of C_3H_4O at idle of the case of C_3H_8O was reduced to about 1/2 of that of kerosene.

41323 **APTIC NO. 63670**

Darling, S. M., R. W. Snyder, and W. T. Wotring

INFLUENCE OF EMISSION CONTROLS ON FUEL AND LUBRICANT ADDITIVES. *Chem. Technol., 1974:356-365, June 1974. 39 refs. (Presented to the American Chemical Society, Petroleum Division, Chicago, Ill., Aug. 1973.)*

Automotive design changes to meet the 1975-1976 emission standards represent a potential discontinuity in fuel and lubricant technology. The changes required in fuel and lubricant additives in the short-term (1975-1980) are discussed. Emission standards, present-day emissions from cars, inspection and maintenance programs, recall of cars, and types of control are mentioned. Catalytic converter use will require limited sulfur content and severely limited lead and phosphorus content in the motor gasoline to prevent poisoning of the catalyst. The use of sulfur and phosphorus in motor gasoline, the influence of P additive on exhaust valve recession, motor oils as a source of sulfur, the consumption of oil, and oil composition are mentioned. Various exhaust control devices such as carburetor, early fuel evaporation plate, exhaust gas recycle, positive crankcase ventilation valve, and spark plugs will require engine cleanliness which can be affected by fuel additives. The effect of additive on carburetor deposits, the temperature of the intake side of the early fuel evaporation plate, the effect of fuel treatments on intake valve deposits, the effect of lead additive on intake valve deposit formation, the effect of exhaust gas recirculation on inlet valve deposits, average intake valve temperatures, influence of jacket temperature on inlet valve temperature, change in manifold vacuum with use of exhaust gas recirculation, influence of oil components and effect of 0.2% solvent oil in fuel on inlet valve tulip deposits, effect of lead on octane, effect of lead on sludge and varnish formation, and effect of fuel detergent-dispersant additive on sludge and varnish formation are described.

41324 **APTIC NO. 63808**

Dawson, J. K.

PROSPECTS FOR HYDROGEN AS AN ENERGY RESOURCE. *Nature (London), 249(5459):724-726, June 21, 1974. 2 refs.*

Storing energy in the form of hydrogen to provide fuel for transport and reduction of iron ore is discussed. One of the largest new uses for hydrogen could be as fuel for road transport. The use of hydrogen requires little alteration to the internal combustion engine and the environmental pollution from hydrogen would be much less than from gasoline. Work is to be done to arrive at the optir[illegible] hydride composition to meet criteria of high hydrogen de[illegible], low overall mass, avoidance of high operating temperatu[illegible] and the ability to withstand multiple recycles. The main obstacle is the expense of the electricity needed to synthesize hydrogen. There is a large market for hydrogen as a substitute for natural gas for the majority of domestic and industrial purposes in which its energy content rather than chemical properties are important. Hydrogen has been proposed as a substitute for aviation hydrocarbon fuel. There is a hydrid fuel economy in which nuclear-based hydrogen could be used to adjust the carbon/hydrogen ratio of fossil fuels, as in the production of substitute oil or gas from coal. In production, the energy could be used directly as high temperature heat to promote thermochemical decomposition, or the nuclear energy could be converted into electricity and used in an electrolysis plant.

41325 **APTIC NO. 65794**

Dietrich, H. and H. C. Gurtler

A NEW TEXTILE FOR HIGH TEMPERATURE FILTRATION OF DUST AND GASES. *Filtration Separation (Purley), 11(4):403, 405, 406, 408, July/Aug. 1974. 5 refs. (Presented at the Filtration Society Conference What's New in Dust Control and Air Cleaning, London, England, Sept. 25-27, 1973.)*

A needle felt capable of filtering dust and gases at 350 C and up to 400 C for short periods is now being commercially produced. It consists of mineral fibers needled on to a supporting scrim of metal cored mineral fiber yarns. It can be used for many heavy filtration duties at high temperatures. Also, the new material can be impregnated with bactericide and used to produce sterile air in hospitals and other areas. It can be used to carry catalysts which oxidize toxic gases. Thus, it can filter out dust and destroy toxic gases at the same time. (Author abstract)

41326 **APTIC NO. 63981**

Dietrich, K. R.

CLOSED SYSTEMS FOR BIOLOGICAL SEWAGE TREATMENT PLANTS IN TUBULAR DESIGNED PLASTIC REACTORS FOR AERATION WITH OXYGEN INSTEAD OR AIR. *(Geschlossene Systeme fuer biologische Abwasserreiningungsanlagen in rohrfoernig ausgebildeten Reaktoren aus Kunstoff zur Belueftung mit Sauerstoff statt mit Luft). Text in German. Wasser Boden, 26(5):138-140, 1974.*

A closed tube reactor with gas exhaust system and scrubber and biological purification of primarily industrial waste water is described which meets all demands concerning odor elimination required by the new Federal Immission Protection Act of April 1, 1974. Length and diameter of the tubular reactor of rigid polyethylene depends on the throughput quantity and the extent of the pollution of the waste water. The waste water enters from the buffer container into the first section of the reactor, passes through the gas exhaust system and from there to the further reactor sections until the entire reactor is filled. The entrance speed of the waste water is slow enough to grant a residence time of three hours reducing the B.O.D.5 (Biological Oxygen Demand) and the potassium permanganate consumption stepwise to a final value of 25 mg/l B.O.D. and 50 mg/l KMnO4. The oxygen supply and the sludge load are adjustable to the conditions in each section. If the odorous substances cannot entirely be removed by scrubbing, combustion of the organic gases at temperatures of up to 1300 C can be applied. A less costly solutio in such cases would be the application of physical chemical purification processes with flocculation, precipitation, and absorption.

41327 **APTIC NO. 63867**

Dohne, Erich and Michael Brenndoerfer

HOW MUCH WANTED IS BIOGAS TODAY? *(Wie aktuell is heute Biogas)? Text in German. Landtechnik, 29(7):302-307, 1974.*

The basic material for the production of biogas is manure with which various organic waste products such as straw and dried plants can be mixed. The extent of gas production in the aerobic rotting process depends on the amount of organic matter. The maximum gas yield ranges from 280 to 600 l/kg organic dry matter. In practical operation, with a residence time of only 20 to 30 days, the average gas production is 200 l/kg organic dry mass. This corresponds to a decomposition of the organic dry matter of about 30%. A longer residence time and thus a further decomposition would not be economical. The heating value of biogas varies depending on the fraction of methane (56-70%) and ranges from 4790 to 6000 kcal/cu m. The mass reduction of the waste products is low (3% at the most). Of the 15 biogas plants in the Federal Republic of Germany none are in operation any more because the price for the biogas was too high in comparison to other energy. Nothing has changed in this respect yet. But it is considered that the biogas process can at the same time be a disposal process for manure and an elimination process for odors sent out by manure, the costs for such processes could be subtracted from the final price of the gas wherever such processes are required for reasons of environmental protection making the process more economical.

41328 **APTIC NO. 63625**

Dorr, Karl-Heinz, Hugo Grimm, and Rolf Kola

A PROCESS FOR ABSORBING GASEOUS COMPONENTS. *(Metallgesellschaft Aktiengesellschaft, Frankfurt-on-the-Main (Germany)) Brit. Pat. 1,345,756. 7p., Feb. 6, 1974. (Appl. Oct. 11, 1971, 11 claims).*

A process for absorbing sulfur trioxide or moisture from a gas using sulfuric acid as the absorbent is described. There are other processes using H2SO4 as the absorbent, but they have marked disadvantages. In the case the towers, the capital cost is too high; in a submerged process, the throughput rate isn't high enough; foam absorbers require a relatively over all weight; and venturi absorbers require an excessive amount of [illegible]gy or pressure drop. This process uses a venturi absorber [illegible] eliminates the disadvantages by using combined co-current and countercurrent absorber which permits absorption of the largest amount (90-98% by volume of the SO3 or moisture) and the dissipation of the resulting heat in the co-current stage requiring absorbing liquid at a low rate and with a low pump capacity. The first absorption stage may be small or operated with a low pressure loss. The second stage operated in countercurrent requires absorbing liquid at a low rate because the concentration can be maintained in an optimum range throughout the stage. This combination permits operation involving a low pressure loss and with a high throughput to be achieved.

41329 **APTIC NO. 63777**

Dzyadzio, A. M., G. K. Bondarev, and V. V. Doroshevskiy

DUST DISCHARGE FROM CYCLONES. *(O vypuske pyli iz tsiklonov). Text in Russian. Pishch. Tekhnol., no. 2:99-102, 1974. 5 refs.*

Dust entrainment from cyclones can be prevented by the use of a plane screen placed in or at a certain distance from the dust discharge opening inside the dust collector which prevents the downward stream from entering the dust collector. The diameter of the screen should be greater than that of the dust discharge opening. The screen can be combined with inverted cone type dust retainer. The screen increased dust separation efficiency of the cyclone in tests with quartz, kaolin, and other dusts.

41330 **APTIC NO. 65771**

Eishoji, Yutaka and Takeo Hamada

AIR PURIFICATION DEVICE. *(Kitai seijo sochi). Text in Japanese. (Assignee not given.) Japan. Pat. Sho 49-23255. 3p., June 22, 1974. (Appl. Oct. 19, 1970, 1 claim).*

A suction fan to be inserted on the wall of buildings for the purposes of cleansing incoming air of dusts and deleterious gases is described. The ventilation fans or exhaust fans usually used are for the purpose of removing soiled air from indoors and usually take in outside air without cleaning it. In this fan, the center fan (or fans) motor is supported by a strong circular plate with holes. The plate has a strong pressure resistance. The plate is inserted in the wall, and is sandwiched between two filter materials containing adsorbent or effective radioactive material. Outside these filters are covered again by plates with holes and the entire unit is securely inserted into the wall. Various commercially available adsorbents are suggested.

41351 **APTIC NO. 65904**

Elfert, Ralph J., Jr.

BUREAU OF RECLAMATION EXPERIENCES WITH FLY ASH AND OTHER POZZOLANS IN CONCRETE. *Bureau of Mines Information Circ., no. 8640-80-93, 1974. 9 refs. (Presented at the International Ash Utilization Symposium, 3rd, Pittsburgh, Pa., March 13-14, 1973.)*

Fly ash was used in thye production of concrete as a pozzolan. Other types of pozzolans used were granite, siliceous silt, sandstone, pumicite, calcined opaline shale, portland-pozzolan cement, calcined diatomaceous clay, pumice, and others. Since 1940, 270,000 tons of fly ash have been used in 7,100,000 cu yd of concrete and 350,000 tons of natural pozzolans in 9,250,000 cu yd. The pozzolanic materials used in concrete are discussed including interground crystalline material, volanic glasses, calcined clays and shales, and fly ash. The typical effects of fly ash and other pozzolans on concrete strength, heat generation, permeability, volume change, and freezing and thawing durability are reviewed. A concentrated effort will be needed in the future to use new types of fly ashes economically.

41332 **APTIC NO. 65837**

Elliott, Thomas C.

SO2 REMOVAL FROM STACK GASES. *Power, 118(9):S1-S24, Sept. 1974.*

Sulfur dioxide removal from stack gases is reviewed, with emphasis on removal from coal-fired boiler stack gas. Potential health hazards of SO2 are reviewed, along with the Environmental Protection Agency s current position. Various control methods are described including use of low-sulfur fuels, conversion of high-sulfur coal or oil to gas, fluidized bed combustion to capture SO2 within the boiler immediately after combustion of coal, coal washing, tail-end removal of SO2, wet SO2 removal systems, throwaway processes and the limestone system and other recovery processes. Stack gas sulfur dioxide throwaway processes include wet and dry systems; recovery processes include absorption by liquids, adsorption, sorption by solids, catalytic reduction, and catalytic oxidation. Various factors in SO2 removal from stack gases are reviewed including the impact of the fly ash content on efficiency, scrubber selection, mist eliminators, stack gas reheating, and lime versus limestone for absorption. Leading stack gas removal methods are discussed including limestone scrubbing, the double alkali process, catalytic oxidation, Wellman-Lord process, citrate process, and dry adsorption processes. The monitoring and control of these removal processes, operational problems, and costs are also reviewed.

41333 **APTIC NO. 63467**

Ettinger, Harry J., John C. Elder, and Manual Gonzales

PERFORMANCE OF MULTIPLE HEPA FILTERS AGAINST PLUTONIUM AEROSOLS (PROGRESS REPORT). *Los Alamos Scientific Lab. of the Univ. of California, Los Alamos, N. Mex., Atomic Energy Commission Contract W-4705-ENG-36, Rept. UC-41, 12p., March 1974. 9 refs.*

NTIS: LA-5544-PR

A multiple HEPA filter system was evaluated using laboratory produced plutonium aerosols with amad s in the range 0.3 to 0.5 micron, and in concentrations high enough for testing three HEPA filters in series. These aerosols contain 10% to 30% of total activity in the aerodynamic size range below 0.22 micron, allowing efficiency measurement of the first two HEPA filters in series for this size interval. Efficiencies of HEPA 1 and 2 exceeded 99.98% for all sizes for Pu aerosol, including the intervals 0.12 to 0.22 micron and less than 0.12 micron. Efficiency of HEPA 3 was 99.75% expressed as the average of eight runs. (Author abstract modified)

41334 **APTIC NO. 65782**

Ferraiolo, G., G. Fumarola, M. Del Borghi, and A. Peloso

APPROACH TO THE ENVIRONMENTAL DESIGN PROBLEMS ALONG THE CHEMICAL ENGINEERING AND CHEMICAL PLANTS CRITERIA. *Quad. Ing. Chim. Ital., no. 5:76-83, 1974. 31 refs. (Presented at the Congress, Reactors in the Chemical Industry, Zakopane, Poland, April 18-20, 1974.)*

The application of chemical engineering principles and methods to the control of air pollution is discussed. Air pollution can be controlled by either reducing the amounts of pollution or the effects. This is done in one of two ways. The reduction of the pollutants substantially consists in suitable apparatuses which are usually based on mass transfer phenomena, mainly gas-liquid absorption. The reduction of the effects is based on the observation that the higher is the point from which pollutants are released into the atmosphere, the more diluted are the pollutant ground concentrations. The pollutant concentration is reduced by stacks. Suitable optimal design criteria for lowering the capital and operating costs of the stacks were developed based on chemical engineering plant designing.

41335 **APTIC NO. 63654**

Finger, Gerd and Martin Hollnagel

FILTERS WITH IRON LAYER - A MODEL FOR LOW RESISTANCE SINTERED FILTERS. *(Eisenschichtfilter - ein Modell fuer widerstandsarme Sinterfilter). Text in German. Chem. Tech. (Berlin), 26(6): 354-359, June 1974. 16 refs.*

A method for the manufacture of sintered layer filters is described. The filter, consisting of a coarse porous carrier frit and a layer with fine pores, was produced under a pressure of 1500 kg/sq cm followed by a two-hour sintering process in reducing atmosphere at 1150 C. This way the 0.3 mm thick carrier frit with an area of 2 sq cm was obtained. The layer with the fine pores was obtained by sedimentation of pulverized carbonyl iron with methanol as sedimentation liquid. The coated carrier frit was then sintered in reducing atmosphere at 900 C. The pressure loss in a filter obtained this way was determined. Under the selected manufacturing conditions an additional pressure loss develops at the boundary layer between carrier and layer. A characterization of the layer filters by their gas penetration and the average equivalent pore size calculated from the gas penetration according to Adzumi is given. For determination of the largest pores in a filter the measurement method according to Bechhold was applied.

41336 **APTIC NO. 63854**

Fischer, Herbert

REDUCTION OF EMISSIONS OF SULPHUR COMPOUNDS FROM SULPHUR RECOVERY PLANTS. A COMPARISON OF PROCESSES. *(Reduktion des Auswurfs von Schwefelverbindungen aus Schwefelrueckgewinnungsanlagen. Ein Verfahrensvergleich). Text in German. Erdoel Kohle-Erdgas- Petrochem., 27(6):292-296, 1974.*

Considering the large number of processes described in the literature for removal of sulfur from waste gases, the proper choice of a suitable process is difficult. After grouping the processes for general information, a comparison of several of them is made for a reduction of the S content in waste gases from a 100 tons/day S recovery plant to a level below 500 ppm S (hydrogen sulfide, sulfur dioxide, carbonyl sulfide, carbon disulfide, and sulfur). Included are the Wellman-Lord process, Beavon process, clean air-sulfur process, Scot process, Zieren process, ammonia process, IFP process, Sulfreen process, and the SFGD process. Most of the sulfur recovery plants are equipped with catalytic or thermal afterburners converting the residual H_2S COS and CS_2, hydrogen, and CO to SO_2, CO_2, and water vapor for reduction of the H_2S concentration to the required 10 ppm. The comparison of the various processes has shown that no afterburner is required for the Beavon, Clean air and Scot processes. An afterburner must precede the Wellman-Lord, Zieren, ammonia and SFGD processes. In the IFP, ASR, Freeport sulfur, and Sulfreen processes the combustion stage (as a true afterburning stage) succeeds the processes.

41337 **APTIC NO. 64042**

Gallaer, Charles A.

CYCLONE. *(Envirotech Corp., Salt Lake City, Utah) Brit. Pat. 1,346,119. 4p., Feb. 6, 1974. (Appl. Dec. 29, 1971, 5 claims).*

An improvement for a cyclone separator was developed. The inlet conduit includes a bottom panel composed of a first section that is attached to the conduit inner sidewall along the lower edge and a second section that is attached to the first section along a diagonal joint extending from the lower edge of the outer widewall adjacent to the inlet of the conduit generally to a point where the radial-axial plane of the outlet of the conduit intersects the cylindrical housing, the second section being attached to the conduit outer sidewall along the lower edge and to the lower wall of the guide. The first section of the bottom panel slopes downwardly from the inlet of the conduit toward the outlet of the conduit. The improvement comprises an inlet conduit which is arranged generally tangentially to the housing, having an outlet in communication with the inlet of the flow guide, an inlet remote from the housing, an inner sidewall and an outer sidewall, and a top wall and a bottom wall. The inlet conduit gradually increases in cross-sectional area from its inlet to its outlet, and the vertical dimension of the cross-sectional area at the outlet of the conduit gradually increases from a minimum at the outer sidewall to a maximum near the inner sidewall.

41338 **APTIC NO. 65937**

Goodsell, Don

THE TIME HAS COME TO LOOK TO ALTERNATIVE FUELS. *Automotive Design Eng., vol. 13:27, 29, 31, Jan. 1974.*

Alternative fuels and sources of automotive power are discussed including methane and natural gas. One of the main disadvantages of liquid CH_4 is the loss through evaporation. There are dangers from explosion of spilled gas and frostburn. The main constituents of exhaust emissions are carbon dioxide, carbon monoxide, and unburned CH_4. With the chemically correct mixture strengh CO_2 is the greatest constituent, with CO less than 0.5%. Less than 0.25% CH_4 was measured over a realistic range of mixture strengths (75 to 120%). Rich running, over 100%, brings about a very rapid rise in CO. A natural gas engine was built by Daimler Benz and installed in a single decker bus. The 172 DIN hp engine was originally conceived as a means of meeting clean air legislation. Emission values were CO 2 gm/bhp/hr; hydrocarbons 3 grm/bhp/hr, and nitrogen oxides better than 5 g/bhp/hr. Added advantages over the diesel are low noise level and almost odorless exhaust gases, but fuel consumption is up approximately 15%.

41339 **APTIC NO. 65901**

Guida, Kent

THE USES OF FLY ASH IN A FERROCEMENT MIX DESIGN. *Bureau of Mines Information Circ., no. 8640:56-60, 1974. 4 refs. (Presented at the International Ash Utilization Symposium, 3rd, Pittsburgh, Pa., March 13-14, 1973.)*

The uses of fly ash in ferrocement are discussed. Ferrocement is a reinforced concrete material which has a high degree of imperviousness and elasticity, excellent resistance to crack propagation, and high strength-weight ratio. Ferrocement mix designs are based on obtaining the highest possible compressive strength and maximum workability. Fly ash addition to ferrocement can produce a lubricating effect which improves workability, penetrability, and ease of finishing, pozzolanic action to give long-term increase in strength, increased sulfate resistance, and inhibition of corrosion of steel when stimulated hydraulically by the lime from the hydration of cement. These effects are described.

41340 **APTIC NO. 63675**

Hammer, H.

FUTURE TASKS OF HETEROGENEOUS CATALYSIS. *(Zukunftsaufgaben der heterogenen Katalyse). Text in German. Chem. Ind. (Duesseldorf), 26(7):419-421, July 1974.*

The two major fields of application of heterogeneous catalysis will be environmental protection and the search for new sources of energy. The economical decontamination of automobile exhausts and of waste gases from combustion processes are an important example. Heterogeneous catalysis can be used to produce substitute natural gas from the developing CO/H_2 mixture from coal gasification. Plants of this kind have recently been put into operation in Scotland. Whether heteregeneous catalysis can be used also for direct hydration of coal to produce substitute natural gas is still an open question.

41341 **APTIC NO. 65769**

Hayashi, Kanemitsu

POLLUTION CONTROLLED CREMATOR. *(Kasoro). Text in Japanese. (Asahi Installation Engineering Co, Tokyo (Japan)) Japan. Pat. Sho 47-21025. 2p., June 5, 1974. (Appl. July 9, 1970, 1 claim).*

Previously crematoria did not eliminate combustion gases containing bad odor and soot. This invention eliminates air pollution. The furnace itself is made of refractory bricks and fire interruption bricks; it consists of a coffin mounting door, a coffin grid, a burner insertion hole for the recombustion chamber, a fuel combustion chamber, a cremation chamber, ash recepticles, combustion gas emission holes and an adjustment damper. Both above and below the cremation chamber and fuel combustion chamber there are gas passages and recombustion chambers. The waste gas is burned again at a very high temperature and odor is completely eliminated. The waste gas is rechanneled into an underground flue passage and is emitted.

41342 **APTIC NO. 64384**

Heitmann, Aloys and Peter Reher

RECYCLING PROCESSES FOR SULPHUR COMPOUNDS. *(Recycling-Prozesse fuel Schwefel-Verbindungen). Text in German. Chem.-Ingr.-Tech., 46(14):589-594, 1974.*

Recycling processes have gained increasing importance because of the rising shortage of raw materials. For the raw material sulfur, however, this is true only to a limited extent, since S is obtained in increasing amounts from desulfurization of natural gas and fuel oil. Therefore, any recycling of S compounds occurs only out of concern for environmental pollution. Familiar processes for the recovery of solid, liquid, and gaseous S compounds are described. Spent acids and sulfates can be recovered by the following processes: preliminary concentration of thin acids to about 70% sulfuric acid; further concentration to 96% H_2SO_4; cracking of acids; and cracking of sulfates. Generally, costs for recovered acids are higher than the production of H_2SO_4 from elemental S. For the purification of sulfur dioxide containing off-gases numerous methods have become known of which the Wellman-Lord process is described in greater detailed. Sulfur dioxide-containing waste gases are scrubbed with sodium sulfite. The spent scrubbing fluid is evaporated in a boiler indirectly heated with steam. The obtained sodium pyrosulfite is mixed with the SO_2 from the vapors of the boiler which have been cooled to 40 C. Sulfur dioxide in pure form leaves the process.

41343 APTIC NO. 63858

Helmer, Richard

OFF-GAS CLEANING IN TRASH COMPOSTING PLANTS BY MEANS OF GROUND FILTRATION. *(Abluftreinigung in Muellkompostwerken mit Hilfe der Bodenfiltration). Text in German. Muell Abfall, 6(5):140-146, 1974. 14 refs.*

One of the best methods for eliminating odors from composting processes is earth filtration since no chemicals, adsorbents, or large quantities of energy are needed. This type of gas cleaning depends on physical-chemical and biological interactions between a flow of air and an earth layer, stationary soil particles, and ground water. In the trash composting plant at Duisburg-Huckingen the odorous air from two bio-stabilizers is drawn off, passed through a wet scrubber, and then entered into a 40 m compost filter with an air throughput of 10,000 cu m/hr. Experience with this operation leads to the following recommendations for filter design. The supply pipe system should consist of several parallel pipes or rings, with perforations in the bottom sections of the pipes. A sand layer above and around the pipes will guarantee uniform distribution of the waste air. This layer should be followed by a filtering layer of loose compost. An irrigation system is required to maintain the humidity of the filter. A drainage system is also required.

41344 APTIC NO. 64203

Henderson, James M. and John B. Pfeiffer

REDUCTION OF SO_2 TO SULFUR. THE ELEMENT SULFUR PILOT PLANT OF AMERICAN SMELTING AND REFINING COMPANY AND PHELPS DODGE CORPORATION. *Preprint, American Chemical Society, Washington, D. C., 14p., 1974. 1 ref. (Presented at the American Chemical Society National Meeting, 167th, Los Angeles, Calif., April 1974.)*

The reduction of sulfur dioxide to sulfur in the elemental S pilot plant of the American Smelting and Refining Co. and Phelps Dodge Corp. is described. Nineteen different primary SO_2 reduction catalysts were evaluated. Various materials of construction in the corrosive hydrogen sulfide and S vapor atmosphere generated in gas phase reduction of SO_2 were evaluated. The preliminary pilot plant design provided for a fixed bed primary reactor of the shell and tube type in which the catalyst would be contained in the tubes. The design of the plant provided for treatment of gas streams having SO_2 concentration from 12-100%. The 12% SO_2 gas stream was generated by burning molten S in a spray type S burner to produce a gas stream with an 18% SO_2 content. The gas stream leaves the primary reactor at equilibrium which amounts to conversion of SO_2 to S vapor of approximately 69% when treating a 12% SO_2 gas and about 80% when reducing pure SO_2. The operation and capital costs are included. A plant producing 200 tons of elemental S/day can be constructed at a cost of $10,000,000.

41345 APTIC NO. 66075

Herbert, I. C.

NEW COPPER EXTRACTION PROCESSES. *J. Metals, 26(8):16-20, Aug. 1974.*

Hydrometallurgical copper extraction processes are reviewed in terms of their reported environmental benefits and compared with the conventional pyrometallurgical routes. Although the hydrometallurgical method is supposedly free of gaseous effluent problems, leach residues are difficult to handlye and pose solid and liquid effluent problems. Leach residue disposal will be difficult unless there is a tailings dump to which they can be sent, whereas the disposal of inert slags from a copper smelter is a relatively straightforward operation. Economically, the production of high strength sulfur dioxide bearing gaseous effluents suitable for the production of sulfuric acid gives the pyrometallurgical route a big advantage in terms of by-product recovery.

41346 APTIC NO. 63648

Hind, M. A. and B. M. Bird

ELECTRIC VEHICLE PERFORMANCE SIMULATION AIDS DESIGN. *Elec. Rev. (London), 194(20):618-620, May 31, 1974. 1 ref.*

The development of a computer simulation program for electric vehicle performance is described along with results obtained from testing some typical electric vehicles to obtain both data for the program and experimental results for comparison with the program results. A set of simultaneous differential equations were generated to describe the dynamic behavior of the vehicle, with further differential equations being added to detail such parameters as the energy consumption of the component parts, energy output, number of ampere-hours consumed, and the state-of-charge of the battery. The differential equations were integrated over a data set detailing the route for the simulated vehicle. Vehicle component modelling equations were also incorporated into the program. Vehicle component data errors of less than 5% were achieved for all components except the battery where errors could not be reduced below about 10%. The minimum set of data necessary to simulate an electric vehicle was: battery model; controller model, including driver response when starting, regulating speed, and stopping; propulsion motor model; transmission system model; vehicle weight and inertia of rotating components; and vehicle drag.

41347 APTIC NO. 64333

Hodgson, J. W.

ALTERNATE FUELS FOR TRANSPORTATION. *Mech. Eng., 96(7):22-25, July 1974. 15 refs. (Presented at the American Society of Mechanical Engineers, Intersociety Conference on Transportation, 1973.)*

By 1980 there will probably be an annual consumption of fossil fuel in excess of 100 billion gal/yr. Since the oil reserves in the continental U. S. and Alaska are conservatively estimated to be 10,000 billion gal, our oil reserves may be depleted in about 100 years. Other estimates are less optimistic. Increased demand for electrical energy has led to the study of nuclear power plants to synthesize fuels such as hydrogen, hydrogen peroxide, and ammonia. Since transportation causes 40% of the U. S. air pollution (60% of the carbon monoxide, 50% of the unburned hydrocarbons, and 35% of the nitrogen oxides), new fuels have been studied for their low-pollution properties. Any fuel such as ammonia that does not contain carbon would not contribute CO, carbon dioxide, or unburned HC. Ammonia would also produce less than 1/5 of the nitric oxide that would be produced by a gasoline-fueled engine -- provided the mixture is fuel-rich. The exhaust from an ammonia-fueled engine would contain unburned ammonia, however, which would be over 95% dissociated into hydrogen and nitrogen. Ammonia would be suitable in a spark- ignition engine since it is relatively inexpensive and available (3 cents/lb), has an extremely high octane rating (130 plus), is easy to store and does not require cryogenic storage, and has a lower heating value than gasoline or liquid hydrogen but would require less volume. Although ammonia is toxic, it can easily, be detected, rises if released, and can be handled safely with caution. Ammonia is readily vaporized. Engines should be made of steel or aluminum to avoid corrosion from ammonia.

41348 **APTIC NO. 63673**

Hoppe, Klaus, Lothar Krell, and Juergen Keller

STUDIES CONCERNING HYDRODYNAMICS AND SUBSTANCE TRANSFER AT THE PERFORM GRID. *(Untersuchungen zur Hydrodynamik und zum Stoffuerbergang beim Perform-Grid). Text in German. Chem. Tech. (Berlin), 26(6):340-344, June 1974. 19 refs.*

The perform grid consists of zig-zag - shaped perforated elements which are piled on top of each other to form a column packing. The fluid which flows counter current to the gas or vapor from top to bottom of the column uniformly wets the gas. Efficient arrangement of the grid elements is possible only with a column diameter of at least 600 mm. Various arrangements of perform grids are described. Due to the low pressure losses of the grid, which at an air velocity of 3.0 m/sec and a fluid quantity of 1 to 5 cu m/sq m hr was only 0.5 to 0.7 torr, it is especially suitable for scrubbing waste gases apart from other separating processes.

41349 **APTIC NO. 65772**

Hori, Motoya

DUST CONTROL AGENT. *(Bojinzai). Text in Japenase. (Assignee nnot given.) Japan. Pat. Sho 49-27034. 2p., July 13, 1974. (Appl. May 13, 1967, 1 claim).*

This invention is designed to prevent the scattering of mine ore dusts, coal powder, and ceramic material in storage bins or during loading and transporting, thus preventing economic losses, pollution, and the possibility of silicosis. The adhesive liquid agent consists of sodium silicate for forming larger and heavier particles, anion or non-ion surfactant, and lignin or bittern for increasing the volume. For unloading and transportation of powder material, the original liquid should be diluted five to 10 times and sprayed over the material during the operation. The general proportion is 5-20% of sodium silicate, 0.1-5% of anion or non-ion surfactant, and the rest, lignin or bittern. As a sample, 3% of non-ion surfactant, 20% of 50 degree sodium silicate, and 77% of bittern were mixed and used without diluting on powdery material. Spraying of this liquid at the ratio of 0.5 l per 1 sq m decreased dusts much more effectively than water, and the liquid was quickly absorbed on the powder surface, forming a film. A 10% solution of this liquid sprayed in the dusty air of a hopper chute controlled the dusts twice as effectively as water.

41350 **APTIC NO. 65815**

Horioka, Masakazu

STUDIES ON SULFUR DIOXIDE REMOVAL BY SYNTHETIC AND HEAT-TREATED RHODOCHROSITE. *(Gosei oyobi shosei sanka mangan ni yoru SO2 jokyo ni kansuru kenkyu). Text in Japanese. Kankyo Gijutsu (Environ. Conserv. Eng.), 3(8):570-572, Aug. 1974. 2 refs.*

Desulfurization of stack gas by the wet method synthetic manganese dioxide and heat-treated rhodochrosite, and the recovery of absorbent were studied by experiments. The manganese dioxide absorbent could be prepared by two valance manganese salt solution and either potassium manganese oxide, or or chlorine, or alkali and then oxidized. It can be prepared by a heat treatment of manganese oxide ore or manganese carbonate ore at 500-1000 C. The MnO2 absorbent was prepared by MnO2 plus MnCl2 and water, and 11% sulfur dioxide gas was passed at 860/ml/min. The temperature was about 20 C. The rate of SO2 removal was, with the synthetic MnO2, 100 g to 61 g of SO2; with the heat-treated rhodochrosite, 36 g. They were both confirmed as suitable for the treatment of SO2. The absorbents can be recovered and reused by oxidizing with potassium permanganate, ammonia, or oxygen.

41351 **APTIC NO. 63775**

Huenlich, Hans-Werner

STATEMENT ON CURRENT PRACTICE FOR THE REDUCTION OF FLUORIDE EMISSION IN THE BRICK AND TILE INDUSTRIES BY SCRUBBING OF THE FLUE GASES. *(Feststellung des Standes der Technik zur Verminderung der Fluoremission in der Ziegelindustrie durch Reinigung der Abgase). Text in German. Ziegelind. (Weisbaden), no. 4:155-162, 1974.*

A state-of-the-art report on the separation of fluorine and sulfur oxides in the brick and tile industry is presented. The sulfur oxides and fluorides generated in firing processes in the ceramic industry are due to the inherent sulfur and fluorine contents of the fuels and raw materials, respectively, which make neutralization and separation of the pollutants the only possible solution. Sulfur dioxide, sulfur trioxide, and gaseous fluorides present in the flue gases in firing processes can be adsorbed and neutralized to form solid particles by dry and wet methods, especially by the injection of lime with subsequent dust separation by means of bag filters or electrostatic precipitators. While the dry processes have increasingly replaced the wet ones, scrubbing with lye solution is especially suitable for the joint removal of sulfur oxides and fluorine.

41352 **APTIC NO. 64419**

Idemura, Hideo

ON EXHAUST GAS DESULFURIZATION. *(Haien datsuryu ni tsuite). Text in Japanese. Sangyo to Kankyo (Ind. Environ.), 3(7):78-83, July 1974.*

By-products produced by an electric boiler capable of 100,000 Kw with the aid of an exhaust gas desulfurizing plant capable of desulfurizing 90% of fuel containing 3% sulfur are calculated to be 0.6, 1.9, and 3.3 tons/hr for sulfur, sulfuric acid, and gypsum respectively. Though sulfur is the smallest in terms of weight and volume , spontaneous combustion can occur when it is stockpiled in the open air. There is no problem with sulfuric acid when there is a good balance between demand and supply; if not, it is difficult to dispose of. Failure to treat exhaust water from an exhaust gas desulfurizer gives rise to water pollution. Exhaust gas desulfurizing processes must be able to operate according to variations in operating conditions of major plants. At present costs, dust desulfurization requires about $11 to $16/Kg fuel. Problems of corrosion within the control equipment are discussed.

41353 **APTIC NO. 63892**

Iida, Yasuo and Toshio Odaira

THE EFFECTS OF CATALYTIC EXHAUST GAS CLEANSING SYSTEM. *(Shokubaishiki haiki gasu joka sochi no koka). Text in Japanese. In: Studies on Tokyo Smog. Tokyo Metropolitan Research Inst. for Environmental Protection (Japan), Rept. 3, p. 141-145, March 1974. 7 refs.*

The catalytic oxidation of carbon monoxide and hydrocarbons, and the redox catalytic reaction CO, HC, and nitrogen oxides are explained with chemical formulas. Using 11 kinds of catalytic oxidation devices, the exhaust gases of cars with various mileages, performances, and deteriorations were studied. Chassis dynamometer and non-dispersive infrared analyzer were used for gas sampling. The initial effectiveness of the platinum group catalysts was more than 90% for CO and more than 75-85% for HC. Other types of catalysts generally ranged between 75 and 80% effectiveness for CO. With the increase of mileage, capacities for both CO and HC cleansing deteriorated. But Pt catalyst performance for cleansing CO remained relatively high, except for the honeycomb structure device, which dropped in its performance rate to 20% after 10,000 km of driving. The palladium-chromium-alumina honeycomb catalyst retained its 60% cleansing rate throughout. The use of the oxidation-reduction catalytic device is not yet as effective as is desired because of the slowness of NOx reduction. The five types of devices used in this experiment showed about the same initial cleansing rates for CO and HC as the Pt catalytic oxidation devices, but only about 62-80% cleansing rate for NOx. One device had no effect whatsoever on NOx. Three devices deteriorated considerably after 10,000 km of driving, but the fifth maintained a 72% performance for NOx, 79% for HC, and 91% for CO.

41354 APTIC NO. 64420

Iijima, Masaycahi

NEW TECHNIQUES UNDER DEVELOPMENT TO ELIMINATE NITROGEN OXIDES. *(Kaihatsu susumu chisso sankabutsu jokyo no shin gijutsu). Text in Japanese. Denki Kyokai Zasshi (J. Japan Elec. Assoc.), no. 607:12-15, May 1974.*

New techniques centering on eliminating nitrogen oxides in exhaust gas are introduced. Methods of eliminating nitrogen oxides under development at present are classified roughly the wet method and the dry method. The former is designed to absorb nitrogen oxides by washing exhaust gas with a chemical solution. The greater part of nitrogen oxides, however, consists of nitrogen monoxide which is chemically inactive. The NO in exhaust gas, therefore, has to be initially oxidized into nitrogen trioxide, nitrogen dioxide, and nitrogen pentaoxide. The latter is designed to reduce NOx in exhaust gas to nitrogen using catalytic reduction. A pilot plant test was conducted to obtain data necessary for selecting the most appropriate process for eliminating NOx by oxidation and absorption employing a method of oxidating and thus absorbing NOx by ozone. Elimination of surplus ozone and the capacity for eliminating nitrogen oxides were also studied. A second pilot plant test will start with 100,000 N cu m/hr of exhaust gas to obtain data for the design, maintenance, and operation of the large-scale equipment, and how to treat gypsum and nitric acid. Selective contact reduction is a dry method of eliminating NOx, in which ammonia gas is used as reducing agent along with a metal catalyst. The first plant test of selective contact reduction was conducted using a boiler of a thermal power plant to obtain data such as the reducing reaction, catalyst efficiency, and efficiency of eliminating NOx.

41355 APTIC NO. 63891

Inoue, Koichi, Mitsuru Utagawa, Yasuo Iida, and Toshio Odaira

ADJUSTMENT OF ENGINE AND EXHAUST GAS ATTENUATION EFFECTS. *(Enjin chosei to haiki gasu gensho koka). Text in Japanese. In: Studies on Tokyo Smog. Tokyo Metropolitan Research Inst. for Environmental Protection (Japan), Rept. 3, p. 132-140, March 1974. 5 refs.*

The effectiveness of engine operation modifications such as spark timing modification and idling modification were studied. The measurements of exhaust gas components were taken in tests with the four-mode operation. Samplings were taken directly from the tail pipe. Carbon monoxide, total hydrocarbons, and carbon dioxide were analyzed by non-dispersive infrared analysis, nitric oxide was analyzed by NOIR, nitrogen dioxide by non-dispersive ultraviolet analyzer, and oxygen by magnetic analyzer. After a continuous measurement, the data was analyzed by a minicomputer. The gas measurements were taken between 0.5 to 7.5% adjustments of the engine at each 1% adjustment, and the engine rotation was also modified in the range of 580 to 700 rpm. Based on the 4.5% adjustment designated by the regulation, the average for 4-mode was modified 0.5%, and resulted in a 54% reduction for CO, a 12% reduction for HC, and an 8% increase for nitrogen oxides. The concentrations of CO and HC were clearly affected by the engine operation, but the pattern of NOx was not clear in relation to engine operation modification. Engine operation modification was quite effective for attenuation of emission gases. For CO and HC control, idling should be modified, and for NOx control spark timing should be modified.

41356 APTIC NO. 63893

Inoue, Koichi and Toshio Odaira

SPARK TIMING CONTROL SYSTEM. *(Tenka jiki seigyo sochi ni tsuite). Text in Japanese. In: Studies on Tokyo Smog. Tokyo Metropolitan Research Inst. for Environmental Protection (Japan), Rept. 3, p. 146-149, March 1974. 7 refs.*

The effectiveness of a spark timing delay device in reduction of exhaust gases and its effect on engine performance were examined. The principle of vacuum dwell angle is utilized. A test engine with a spark time control device was operated on a chassis dynamometer and exhaust gas was analyzed by the direct concentration method and CVS (constant volume sampler). Non-dispersive infrared and non-dispersive ultraviolet analysis were used, and for the CVS method, chemiluminescence and flame ionization detection were used. The maximum delay dwell angle was 3.4 degrees for car A, and 3.9 degrees for car B. With 10-mode driving, a 7-32% decrease of nitrogen oxides was achieved, but the amount of hydrocarbon and carbon monoxide fluctuated depending on the car type. The average measurements were about the same. The four-mode test at a constant speed showed less NOx and HC and the reduction rate was much greater than with 8-mode or 10-mode driving. When the driving speed fluctuates much, the effectiveness of the control device is limited, but it is still effective for NOx reduction. The fuel consumption increases by 1-6%, and acceleration performance is slightly poorer, but within 40-60 km/hr it does not change much. In actual driving, the device will not hinder the performance in any way.

41357 APTIC NO. 64367

Ioka, Seiji

DEODOR OF VACUUM EVAPORATOR CONDENSATES. *(Shinku johatsukan gyoshukusui no dasshu ni tsuite). Text in Japanese. Kami-Pa Gikyoshi (J. Japan. Tech. Assoc. Pulp Paper Ind.), 28(6):22-29, June 1974. 6 refs.*

A deodorization process for kraft mill effluent using a reduced pressure deodorization tower is described. Odors such as hydrogen sulfide, methyl mercaptan, dimethyl sulfide, and dimethyl disulfide are containedin drainage from various processes in the kraft mill. A greater part of malodorous drainage is discharged as vacuum evaporator condensates. The existing air stripping process is economically advantageous, while thesteam stripping process is costly but superior in BOD removal efficiency. The cost reduction in the steam stripping was attainable by reducing the pressure, and thus decreasing the amount of steam to 2/5. The reduced pressure steam stripping system, laboratory scale deodorization system, and stripping tower are described with flow diagrams. The 99% stripping efficiency were achieved by both laboratory scale and pilot plant tests. The maximum removal efficiency of COD and BOD were 15-35% and 10-40%, respectively. The odor-absorbing system for non-condensing gases is described with a flow diagram. The vapor discharged from the vacuum evaporator is cooled for partial condensation and then led into the washing tower where the odor contained in the vapor is absorbed into the digester liquor sprayed into the tower. In this process, H2S and CH3SH are removed primarily with 90% desulfurization efficiency.

41358 APTIC NO. 65852

Ito, Tomoji and Ryusuke Izumi

VISCOUS COATING LIQUID FOR SUSPENDED PARTICULATE FILTERS. *(Fuyujin jokyo firutayo nenchakueki). Text in Japanese. (Assignee not given.) Japan. Pat. Sho 49-31502, 3p., Aug. 22, 1974. (Appl. July 16, 1970, 1 claim).*

Previously known polyoxyalkylene oxide filter coatings had a low viscosity and for high temperature automobile exhaust gases did not collect dusts effectively. A composite of polyoxyalkylene oxide with glycerine has satisfactory viscosity at any temperature. Various proportions of the mixture can be utilized for coating a filter for automobile exhaust gases or other types of filters for collecting suspended particulates in the air or gas. Used filters can be washed by water, and by spraying or coating the filter with the same liquid the filters can be used repeatedly. The composite is quite stable and maintains its viscosity. For using the liquid for an air cleaner or room cooler filter, 90% of polyoxyalkylene oxide and 10% of glycerin mixed together is quite suitable. For stack filters for collecting dusts of high temperature gases, the proportion should be 60-70% and 40-30%.

41359 **APTIC NO. 65795**

Javorsky, Bruno

FUME CONTROL AND GAS CLEANING WITH AN INDUSTRIAL SCALE FOAM BED SCRUBBER. *Filtration Separation (Purley), 11(4):395-396, 398, 400-401, July/Aug. 1974. (Presented at the Filtration Society Conference What S New in Dust Control and Air Cleaning, London, England, Sept. 25-27, 1973.)*

A foam bed scrubber was successfully installed at a Swedish factory where it cleans fumes and gas containing particles down to 0.5 micron at the rate of 30,000 cu m/hr. The equipment is called the Foamator process because its principle is to make particles adhere to wet foam bubbles which are self-reproducing. This first industrial scale foam scrubber, operating variables, and efficiency are described. (Author abstract modified)

41360 **APTIC NO. 64231**

Johnson, T. E., A. G. Sliger, P. A. Lefrancois, and D. O. Moore

EVALUATION OF THE REGENERATIVE PRESSURIZED FLUIDIZED-BED COMBUSTION PROCESS (FINAL REPORT). *Kellogg (M. W.) Co., Houston, Tex., Environmental Protection Agency Contract CPA 70-68, Task 9, Program Element 1AB013, Rept. EPA-650/2-74-012, ROAP 21ADE-10, MWKLG-RED-74-1284, 91p., Feb. 1974. 19 refs.*

NTIS: PB-232012/AS

Results of an in-depth literature search into the regeneration chemistry of calcium sulfate and CaSO4 magnesium oxide and an evaluation of this chemistry are presented along with recommendations for potential processing schemes. Included are process flow sheets, material balances, process descriptions, and solids handling techniques for both one step and two step regeneration. Areas where additional experimental data are needed to confirm assumptions are delineated. Esso Research and Engineering has conducted fluidized limestone bed coal combustion process using either limestone or dolomite as the sulfur dioxide acceptor. This process requires a regeneration step to convert the sulfated acceptor back to lime for recyle to the combustor. Here, two processes embodying different regeneration concepts have been developed. The first is a 1-step regeneration process which operates at high temperatures and produces a concentrated sulfur dioxide stream for further processing to elemental sulfur. The second is a 2-step regeneration process which operates at relatively low temperatures and produces a hydrogen sulfide stream for conversion to elemental sulfur. With the exception of the regeneration reactors and the combustor, the processes require only commercially proven concepts and technology to be workable. From this standpoint then, the regenerable limestone/fluidized bed boiler concept provides the potential nucleus for a viable coal desulfurization process. (Author abstract modified)

41361 **APTIC NO. 63659**

Joksch, Hans-Otto

DEVELOPMENTAL TRENDS FOR THE APPLICATION OF THE GAS TURBINE IN POWER ECONOMY. *(Entwicklungstendenzen fuer die Anwendung der Gasturbine in der Energiewirtschaft). Text in German. Energietechnik, 24(6):238-243, June 1974. 15 refs.*

The oldest gas turbine (with 25 MW) in East Germany is in operation in Erfurt-Gispersleben. In 1963 the first block of the 25 MW gas turbine power plant Grimmenthal was put into operation. In 1964 a 12.5 MW gas turbine went into operation in Pirna and in 1971 a four package gas turbine was put into operation. The international trends of application of gas turbines are discussed with special regard to attempted improvements of the degree of efficiency by utilizing the waste heat of gas turbine plants. For heat utilization of gas turbines the following options exist: utilization of waste heat in waste heat boilers and supply as remote heat; combination of gas turbine plants with conventional power plants and use of the hot waste gases of the gas turbines for water preheating or as primary air in steam boilers; and increase of the power output through injection of steam into the gas turbine cycle or by connection of a condensation turbine for use of the waste heat steam. All these methods are in use in the German Democratic Republic.

41362 **APTIC NO. 65826**

Juettemann, H.

METHODS OF HEAT RECOVERY AIR CONDITIONING SYSTEMS. *(Verfahren zur Waermerueckgewinnung in lueftungstechnischen Anlagen). Text in German. Heizung Lueftung Haustech., 25(8):243-252, Aug. 1974.*

Methods of heat recovery in ventilation and air conditioning systems are surveyed. Heat recovery is possible by means of tubular, plate type, slowly rotating or high-speed heat exchangers, heat exchangers using water or another cooling agent, such as frigen, as an intermediary heat exchanging medium, or by means of heat pumps for which the enthalpy of the exhausted air represents a useful source of heat. All these heat recovery methods are based on the principle of extracting the waste heat from warm air that is to be exhausted from the heated space and transferring it to the cold fresh air to be admitted in providing for complete separation of the two circuits, i.e., preventing the reentry of used, contaminated air. The use of heat recovery in ventilation systems contributes to energy savings in space heating, and possibly even in cooling.

41363 **APTIC NO. 64366**

Kamino, Kozo

PURIFICATION OF INDUSTRIAL EXHAUST GASES. DUST COLLECTION EQUIPMENT. *(Kogyo haigasu no joka ni tsuite. Shu to shite shujin sochi ni tsuite). Text in Japanese. Nenryo oyobi Nensho (Fuel and Combustion), 41(6):481-495, June 1974. 4 refs.*

Dust collectors adequately equipped for the submicron aerosols are limited to electrostatic precipitators, filtration systems, and venturi scrubbers. Electrical precipitators are most effective for particles smaller than 1 micron. The applicable range of these three types of dust collectors according to the particle size, performance, effects of dust properties (adhesiveness), dust concentration, dust composition (chemical composition, hydrophilic component, specific resistance of components), gas temperature, and production process of particulates (mechanical or chemical) are described and evaluated. The dust collector system and dust collecting efficiency are evaluated from the economic viewpoint. The present status of electrical precipitators performance characteristics, and economic aspects are reviewed in comparison with the other dust collectors. Among parameters affecting the performance of electrical precipitators, the specific resistance of dust has the greatest effect. Recently developed super high voltage electrostatic precipitators with wide electrodes distance are described with mechanical, structural, and performance characteristics.

41364 **APTIC NO. 64364**

Kawasaki, Hideo

NOX REMOVAL DEVICE BY THE NE-METHOD. *(NE-hoshiki ni yoru NOx jokyo sochi). Text in Japanese. Nenryo oyobi nensho (Fuel and Combustion), 41(6):540-548, June 1974. 2 refs.*

The NE-method is a wet oxidation absorption method for the removal of nitrogen oxides developed by Nissan Engineering Co., Ltd. The oxidation absorption of NOx varies with the ratio of nitric oxide and nitrogen dioxide and the presence of oxygen, carbon dioxide, sulfur dioxide, and other components. Four NE- processes for gaseous mixtures of different compositions were developed. The absorption in alkali and permanganate solutions was investigated, and the absorption rate in permanganate solution was excellent at any NO/NO2 ratio, while the absorption rate varied greatly with NO/NO2 ratio in the case of other absorbents. The reaction mechanisms and effects of NOx inlet concentration, alkali or manganese concentration, NOx composition, temperature and presence of other gases (CO2, SO2, etc.) were investigated. The reaction mechanisms and procedures for regeneration of Mn and alkali are described. The NE-A process consisting of a washing tower (preliminary absorption of NOx, SO2, hydrogen chloride, hydrogen fluoride), alkali absorption tower (NO + NO2, SO2, HCl, HF) and NE-absorption tower (NOx) and similar NE-B, NE-C and NE-D processes with modifications are shown with flow diagrams. The reaction mechanisms, performance characteristics, and economical considerations of each process are given.

41365 **APTIC NO. 64296**

Kawase, Buntaro, Iwao Kojima, and Kunio Otani

METHOD OF REMOVING MERCURY VAPOUR FROM GASES. *(Showa Denko K. K., Tokyo (Japan)) Brit. Pat. 1,351,950. 3p., May 1, 1974. (Appl. June 21, 1971, 6 claims).*

A method is described for the removal of mercury vapor from byproduct hydrogen gas generated from a mercury electrolytic cell used for caustic soda manufacture. The mercury can be removed from the hydrogen gas by means of a simple washing operation with an acid solution containing dissolved persulfate ions of 0.5- 1.5% by weight on the basis of the acid solutions. Oxalic acid, sulfamic acid, sulfuric acid, hydrochloric acid, and nitric acid may be used, with the optimum acid concentration being 10-30% by weight. The treatment reduces the residual content of mercury in the hydrogen gas to less than 0.01 mg/cu m.

41366 **APTIC NO. 65847**

Kempen, H. W. J. and R. A. C. van Akkeren

NATURAL GAS AS AUTOMOBILE FUEL (PART 2). *(Aardgas als brandstof voor mortorvoertuigen (II)). Text in Dutch. Gas (The Hague), 97(7):228-234, July 1974.*

Economic aspects of the use of liquefied natural gas as automobile fuel are discussed with respect to the respective capacities of currently available production facilities in cryogenerators (PPG-400 and PPG-2500). To make the production of liquefied natural gas economical, large-capacity production plants are necessary, which accordingly also requies a commensurate market for this product. To preserve the economic advantages of liquefied natural gas due to its lower price compared with gasoline despite the considerable conversion costs on gasoline engine-powered automobiles, conversion is especially recommended for automobiles with high yearly fuel consumption, e.g., autobusses, trucks, and utility vehicles. Due to their very low pollutant emissions, liquefied natural gas-powered vehicles are of special interest in urban areas.

41367 **APTIC NO. 65860**

Knizia, K.

THE COAL CONVERSION PROCESS BY THE UNITED POWER PLANTS OF WESTPHALIA. *(Das VEW-Kohle-Umwandlungsverfahren). Text in German. VGB Kraftwerkstechnik, 54(8):525-531, Aug. 1974.*

The coal conversion process used by the United Power Plants of Westphalia and its possible applications are described. In this process, the crushed and predried coal is degassed and partly gasified in a gas generator, during which time the sulfur present in the coal is converted into hydrogen sulfide, which together with the carbon dioxide is subsequently washed out and possibly utilized or marketed. The residual coke together with the ashes and tar is then sent to the melting chamber of the steam generator where the ashes are removed. After desulfurization, the purified gas is fed into an external circuit and/or to a gas turbine for electricity generation. The raw gas from the gas generator can be directly used as fuel in a conventional power plant. The calorific value of the purified gas varies from 3200 to 3500 kcal/cu m. The purified gas can be used as reducing agent, heating gas, as raw material for various chemical processes, or be conveyed via pipelines to remote areas for electricity generation. The conversion process has the advantages of increased economy of electricity generation with desulfurization, of additional gas generation, and, in long-term prospects, of the use of the waste heat from high-temperature nuclear reactors for this process.

41368 **APTIC NO. 64397**

Kobylinski, Tadeusz P. and Brian W. Taylor

PROCESS FOR REDUCING THE CONTENT OF NITROGEN OXIDES IN THE EXHAUST GASES FROM INTERNAL COMBUSTION ENGINES. *(Gulf Research and Development Co., Pittsburgh, Pa.) U. S. Pat. 3,784,675. 8p., Jan. 8, 1974. 6 refs. (Appl. Dec. 13, 1971, 19 claims).*

A method for the reduction of nitrogen oxides in exhaust gases from internal combustion engines is described. Nitrogen is selectively formed as the only significant nitrogen containing product. This elimination of the formation of excess amounts of ammonia is an improvement over other control processes. The exhaust gases are contacted at a temperature of at least 400 F in a reducing atmosphere with about 0.003 to about 0.5 troy ounce of ruthenium reduction catalyst per 1000 cu ft of exhaust gas/hr. (Author abstract modified)

41369 **APTIC NO. 65831**

Koch, H.

INVESTIGATIONS AND MEASURES FOR THE REDUCTION OF GAS TURBINE EMISSIONS. *Sulzer Tech. Rev., Switz., 56(2):61-67, 1974. 4 refs. (Presented at the CIMAC Congress, Washington, D. C., April 5-9, 1973.)*

Two types of combustors are described for which nitrogen oxides and smoke characteristics are presented in terms of lbs nitrogen dioxide/10 to the 6th power Btu and smoke spot number versus percentage load. The tests were carried out on full scale experimental combustors burning distillate No. 2-GT. With the full scale experimental combustor, low NOx values were reached with a combustor of Type B having 90,000 kW heat loading and fuel injection from a single atomizer. At full load, 0.5 lbs NO2/10 to the 6th Btu was measured. The NOx characteristic was independent of the load to a large extent, and had a decreasing tendency in places. The formation of general criteria for the design is subject to further research. The combustor Type B2 showed a somewhat better result than Type A. A disadvantage of combustor A was the load-dependent NOx characteristic. A disadvantage of combustor B2 was the higher smoke tendency. The effects of water and steam injection, pressure, and type of fuel on NOx and the effect of burner type on smoke were also studied. Particulates were also measured. Steam generation standards and NOx and smoke measurement methods are mentioned. (Author abstract modified)

41370 **APTIC NO. 63751**

Komatsu, Shigeru

ON SCRUBBING OF GASES WITH CEILKIT SCRUBBER. *(Serukitto sukuraba ni yoru gasu senjo). Text in Japanese. Mitsubishi Jushi Giho (Mitsubishi Plastics Tech. Rev.), no. 7:48-58, Feb. 1974. 5 refs.*

Ceilkit scrubbers, developed by the Mitsubishi Resin K.K. and the CEILCOTE Co. of the United States are wet scrubbers of various types. The Ceilkit VCP (Vertical Countercurrent-flow Packed scrubber) and HRP (Horizontal Rectangular Packed scrubber) are introduced. The VCP is mainly for a single gas and mist scrubbing, and HRP is for mixed gases mists, dusts, and deodorization. There is a variety of packing materials, which can be largely divided into the extended surface packing type and the fibrous packing type. Among them, Tellarette is superior in that the space ratio is greater (88%) than other types of packing material, and the pressure loss is extremely small, the circulation liquid quantity is smaller, the power cost is lower, the elimination rate greater, the installation space requirement smaller, the compaction strength greater, and it is also applicable for dust elimination. Design specifications with calculation methods are presented.

41371 **APTIC NO. 64378**

Komuro, Yutaka

THE NOX COUNTERMEASURES FOR POWER PLANT BOILERS. *(Hatsudensho boira no NOx taisaku). Text in Japanese. Boira Gishi (Boilermen), 29(2):97-110, Feb. 1974.*

Most of the presently operating boilers have been modified by combustion improvement devices over many years, and to control combustion conditions for the purpose of reducing nitrogen oxides is structurally and functionally difficult. Problems such as instable combustion, soots, and local overheating of the boiler are often encountered. The presently known methods of adjustment were tested on various boilers at several power plants. Low excess air combustion was found best when the excess ratio was 1.2-1.3. The nitrogen dioxide reduction rate was 15-25% for 1% oxygen. Simulated two-stage combustion (burner cut, bias combustion) was relatively effective, but emission of carbon soot, carbon monoxide, and the danger of local overheating preclude long-term operation. The use of damper adjustment in these tests was very ineffective; but at one plant an adjustment of the damper opening by 1/4 to 5/1.5 resulted in an increase of NOx by 30 ppm. This indicates that damper adjustment could be an effective method of NOx control. According to reports, about 10% reduction of NOx can be achieved by the control of flue gas recirculation; but in these tests, no significant improvement was noted. Reduction of the combustion air temperature by about 35 C did not show any improvement. The most effective reduction was about 49%, achieved by expanding the diameter of the burner throat to decrease the rate of air flow.

41372 **APTIC NO. 63473**

Kummer, J. T.

OXIDATION OF CO AND C_2H_4 BY BASE METAL CATALYSTS PREPARED ON HONEYCOMB SUPPORTS. *Preprint, Ford Motor Co., Dearborn, Mich., Scientific Research Staff, 32p., May 30, 1974. 22 refs.*

The oxidation of carbon monoxide and ethylene by base metal catalysts prepared on honeycomb supports was investigated. Small honeycomb catalysts with tricobalt tetraoxide or copper chromite as the active phase were tested. The activity of the base metal honeycombs towards CO oxidation was good with the temperature of 1/2 conversion at 80,000/hr space velocity in the order of 500 F after aging 16 hr at 1500 F. The hydrocarbon activity as judged by C_2H_4 oxidation is inferior to platinum honeycombs. Both Co_3O_4 and copper chromite are poisoned by sulfur due to the accumulation of sulfate groups on the catalyst surface. A 3 in. long honeycomb using cobalt oxide as the active catalyst is too sensitive to S poisoning to be useful. The activity of the 4.5 in. honeycombs using copper chromite as the active catalyst and mounted 4 in. from exhaust flanges of a vehicle appears somewhat less than desired when used on low S fuel (144 ppm S).

41373 **APTIC NO. 64415**

Kuzuoka, Tsuneo

INFORMATION OBTAINED FROM A TOUR OF INSPECTION IN SIBERIA IN WINTER ON ENVIRONMENTAL POLLUTION. *(Fuyu no Shiberiya kenbunki - kogai shisatsu -). Text in Japanese. Kemikaru Enjiniyaringu (Chem. Eng.), 19(6):534-537, June 1974.*

Environmental pollution measures in Irkutsk are aimed at a centralized heating system controlled by a center called TETS to supply electricity and thermal energy. Construction is now in the first stage. Coal produced 100 Km west of this town have been used for 200 years but at present is being replaced by a large-scale electric boiler. A part of the former coal combustion, in this case, remains unused since it costs too much to convert coal combustion completely into electricity. Air pollution is monitored by requesting industries to report data gathered every 4 min during 1 day/mo. Related water pollution problems are indicated.

41374 **APTIC NO. 65910**

Lamb, D. William

ASH DISPOSAL IN DAMS, MOUNDS, STRUCTURAL FILLS, AND RETAINING WALLS. *Bureau of Mines Information Circ., no. 8640:170-179, 1974. (Presented at the International Ash Utilization Symposium, 3rd, Pittsburgh, Pa., March 13-14, 1973.)*

Although 20% of the fly ash produced in the U. S. by power plants is now being utilized in a variety of beneficial applications, the balance is dumped, presenting a major disposal problem. The problem of developing a large market for use of the fly ash still exists. The properties of fly ash as a fill material are discussed to present a new use for fly ash in dams, mounds, structural fills, and retaining walls. The properties of major importance are grain size, density, compaction characteristics, shear strength, and permeability. These are reviewed, and examples of fly ash utilization as a structural fill and for applications of this material in the U. S. are given. Problems associated with fly ash fills and a conceptual design for a fly ash dam are also discussed. Field trials should be conducted for any large project to enable realistic design parameters to be established and specifications to be prepared. In view of the real risk of liquefaction, the hydrostatic pressure within the body of ash fills should be monitored throughout the construction and operational life of the structure, and construction operations should be adequately controlled to ensure compliance with the specifications, particularly with regard to compaction and drainage details.

41375 **APTIC NO. 63957**

Lehrer, I. H.

MECHANICAL SEPARATION PROCESSES. *PACE, 27(2):21-26, Feb. 1974. 6 refs.*

Mechanical separation processes which transform a mixture of materials into two or more products that differ in composition are discussed. The heterogeneous systems considered consist of continuous phases and dispersed phases. Any of these can be gas, liquid, or solid, but a gas-gas mixture is a single phase. From a process viewpoint, the important systems are those with liquid or gas continuum. Mechanical separation operations are largely governed by the particle-fluid mechanics prevailing in the system discussed. Gravity sedimentation can be used when particles are large enough to settle at practical rates. Combined with this may be the removal of soluble material from the dispersed phase, and continuous countercurrent arrangements can be used. Sedimentation can be used simultaneously for separation and size classification. Filtration is the separation of particles from the fluid in which they have been dispersed, using a medium that allows the fluid to pass but retains the particles. Using electrical separators, small solid and liquid particles can be separated from the gas in which they were dispersed under humid conditions and with low pressure drop. The functions in the separation process are gas ionization, production of electric field, gas residence in the electric field to allow particle travel to collection surface, agglomeration at collection surface to prevent re-entrainment. Electrical energy can also be used to separate the components of a mixture of particulate solids that differ in electrical properties.

41376 **APTIC NO. 65878**

Lockhart, Bruce D. and Stanley L. Genslak

CATALYTIC CONVERTER TESTING WITH PORTABLE ENGINE DYNAMOMETERS. *Preprint, Society of Automotive Engineers, Inc., New York, 29p., 1974. (Presented at the Society of Automotive Engineers, Automobile Engineering Meeting, Detroit, Mich., Feb. 25, 1974, Paper 740245.)*

A catalytic converter test facility was developed using engine dynamometers to age the catalyst. The engine operating parameters and the input to the catalyst were set to duplicate the environment of the catalyst during vehicle tests on the Federal Appendix D Durability Schedule. Results from the experimental car durability test showed that the primary cause of catalyst performance loss on this schedule was due to contamination build-up on the catalyst surface. Catalysts aged on the engine dynamometer showed very good performance loss correlation to similar catalysts aged in the vehicle tests. This correlation allowed the use of the engine dynamometer facility to investigate various catalyst parameter effects on the durability of the catalyst. (Author abstract modified)

41377 **APTIC NO. 65903**

Lovewell, C. E. Sam

PORTLAND-POZZOLAN CEMENT. *Bureau of Mines Information Circ., no. 8640:75-79, 1974. (Presented at the International Ash Utilization Symposium, 3rd, Pittsburgh, Pa., March 13-14, 1973.)*

Fly ash is being increasingly used in production of cement and concrete. In 1971, 8.6 million tons were utilized, compared with only 2 million tons in 1965. The use of fly ash in the manufacture and proper use of type I-P portland-pozzolan cement is reviewed. During the past 20 years, fly ash has been used to improve the quality of concrete in a number of ways. The fly ash is a pozzolan agent which works with lime to produce strong, durable cementitious compounds. The fly ash particles affect the concrete in the plastic stage and contribute to increased plasticity, usually with less mixing water, improving placing and finishing. Fly ash also contributes to the sulfate resistance of concrete, and reduces the heat of hydration. Fly ash, either blended at the mixer or blended at the cement plant, can contribute important properties to ready-mixed concrete, concrete block and pipe, and prestressed and/or precast concrete.

41378 **APTIC NO. 64404**

Maekawa, K.

PRACTICAL MEASURES FOR BUILDING MANAGEMENT WITH AN EMPHASIS ON ROOM AIR POLLUTION CONTROL. *(Shitsunai kuki osen seigyo o chushin to shita biru kanri no gutaisaku). Text in Japanese. Kuki Seijo (Clean Air - J. Japan Air Cleaning Assoc., Tokyo), 11(2):45-64, March 1974. 17 refs.*

The degree of indoor air pollution is dependent on the outdoor air pollution, but the factors are somewhat complicated. The major factors in indoor air pollution are characteristics of air conditioners, the structure of the building, and the ventilation facility. Indoor dust concentrations in three large buildings in Tokyo and one building in Osaka were measured by the optical and weight methods from 1967 through 1968. Air was sampled at 3 l/min for 10 min every hour and the optical density was measured. It was also sampled at 10 l/min for 2 to 4 hr with a glass fiber filter and the dusts were weighed. The dust concentration outside the building in Osaka was 0.05 while that in the building was 0.02. The dust concentration was significantly reduced when a dust precipitator was attached to the air conditioner. The outdoor dust concentration was 0.0715 and indoor air-conditioned concentration was 0.0375 for the building in the center of Tokyo. The indoor dust concentration was about 1/2 the outdoor concentration when air conditioned. The outdoor sulfur dioxide concentration was also considerably higher than the indoor concentration, sometimes three times higher depending on the date and the location. High efficiency air cleaning can be achieved simply by good maintenance of air cleaning apparatus.

41379 **APTIC NO. 65766**

Maeshiba, Sosaburo

GASOLINE STATION UNDERGROUND TANK EXHAUST GAS TREATMENT DEVICE. *(Gasorin sutando ni okeru chika tanku yori no haiki gasu shori sochi). Text in Japanese. (Showa Appliances Engineering Co., Ltd., Fukuoka (Japan)) Japan. Pat. Sho 49-32596. 2p., Sept. 3, 1974. (Appl. March 26, 1968, 1 claim).*

A simple and economical device for capturing the bad odor and deleterious effects of gasoline vapor emitted from underground tanks of gasoline stations is described. The invention is based on the idea of passing the gasoline evaporation through a higher boiling point and less odorous kerosene before emission. The gasoline vapor from the underground gas tank is led into a smaller kerosene tank on the ground surface. The exhaust pipe has a valve before entering the kerosene tank. The pipe enters the kerosene tank from the upper wall and descends into the kerosene pool and ends with a horizontal pipe with many holes at the bottom of the tank. The holes let gasoline vapor out, which will be dispersed in kerosene by a metal screen and dissolve. There is an exhaust pipe on the cover of the kerosene tank which is protected from rain with a small shade. Kerosene vapor has very little odor. The used kerosene can be easily renewed and gasoline can be recovered.

41380 **APTIC NO. 65814**

Masuda, Nobuo

THE NOX CONTROL AUTO-RECIRCULATION BURNER. *(NOx boshiyo jiko saijunkan bana ni tsuite). Text in Japanese. Nenryo oyobi Nensho (Fuel and Combustion), 41(9):798-808, Sept. 1974.*

In combustion and attendant creation of nitric oxide, thermal NO quantity is controlled by combustion at the lowest possible temperature, avoidance of localized or temporary high temperature, low oxygen partial pressure combustion, and the shortest possible combustion time. The self-recirculation burner utilizes a combustion system of medium or small scale and operates in the same way as the previous burner, at the same time achieving low NO emission. The combustion gas (not the flue gas) is recirculated. Usually in the flue gas recirculation, a special fan is used, but in this case, the Exeter effect, the injection energy itself sends combustion gas into the recirculation channel. The Daido Caloric Burner works on this principle; fuel is mixed with the recirculation gas and the temperature rises to 600-800 C; liquid fuel is completely gasified and combustion conditions similar to that of fuel gas are achieved. The gas-fuel reaction creates aldehydes and other unstable substances and quickens combustion speed; complete combustion is achieved in short time. The fuel is mixed with gas at high temperature, which expands the volume of fuel, and the mixture becomes even, avoiding localized high temperature. The burner controls NO emission and by achieving complete combustion, also controls carbon monoxide and soot.

41381 **APTIC NO. 65763**

Matsuo, Shoichi and Itaru Matsuo

FLUE GAS ODOR FILTER DEVICE. *(Haigasu no shuki roka sochi). Text in Japanese. (Assignee not given.) Japan.*

Pat. Sho 49-29633. 2p., Aug. 12, 1974. (Appl. Dec. 4, 1969, 1 claim).

This bad odor deodorization filter device has an outer case comprising a large pipe which is connected to the odor exhaust pipe. The pipe has in it a spiral air pipe with many pores, through which, as the gas passes, the odor elements come in contact with the deodorizing packing material that surround the spiral air pipe. The filter material is a special ancient clay quarried at a limited specific district in Nagasaki Prefecture and contains 32% special organic clay formation, 0.97% nitrogen, 37.01% ash, 102 ppm phosphorus, 0.43% potassium, 0.168% calcium, 2.08% iron, 17.42% silicon, 0.13 ppm arsenic, 0.01% sodium, 0.7 ppm boric acid, 1.23% mg fluorine, 8.87%, mg manganese, 0.025% magnesium, 3.4 ppm copper, 0.2 ppm cobalt, 11 ppm zinc, and 8.6% water. A necessary appropriate catalyst can be added for preservation, or small quantities of manganese dioxide, zinc oxide, lithium, oxide, of alumina can be added, and as binding material, small amounts of sugar and magnesium chloride are added. The mixture is formed into small particles, dried, and packed in the filter tube.

41382 **APTIC NO. 65765**

Matsuo, Masaharu

TREATMENT METHOD FOR ACID SMUT IN OIL FURNACE FLUE GAS BY POURING AMMONIA GAS. *(Juyu nenshoro ni okeru endonai haigasuchu ni ammonia gasu o chunyu shite shujinki de hoshu shita sansei dansuto no shoriho). Text in Japanese. (Assignee not given.) Japan. Pat. Sho 49-31426. 3p., Aug. 21, 1974. (Appl. March 27, 1970, 1 claim).*

This invention is designed to prevent acid smut emission from thermal power generation boilers. In the area of gas temperature 135 C, just before the flue gas dust collector, a mixed gas of ammonia gas and air is injected. This is immediately after sulfur dioxide gas and water have been adsorbed by flue dusts; reacting to sulfur trioxide and water, ammonia gas forms a coagulation of ammonia sulfate or acidic ammonia sulfate around the core of the fuel oil dust. The coagulate of dusts is covered by ammonia sulfate on the surface, but the inner structure still contains SO3 and sulfuric acid mist, and the treatment with water will create a strong acidic waste water which will require treatment. Also, if a low heat treatment is applied to the separation of SO3 gas or acidic mist, it will cause corrosion of the equipment. But in this invention, ammonia sulfate is transported in a vacuum reaction transportation tube where acidic dusts and ammonia gas react, neutralizing and stabilizing ammonia sulfate. The amount of ammonia gas required in the vacuum tube is minimal. The recovered ammonia sulfate can be utilized as a fertilizer material.

41383 **APTIC NO. 63732**

Matsuoka, Hiromasa, Norikazu Tabata, Kenkoku Azuma, Mitsuo Maeda, and Shigeki Nakayama

TREATMENT OF WASTE OZONE. *(Hai ozon shori). Text in Japanese. Mitsubishi Denki Giho (Tokyo), 48(4):438-443, April 1974. 8 refs.*

Ozone can be used in the deodorization of air and water. An electron accelerator used in the chemical industry exhausts an effluent containing ozone. Waste ozone from these sources must be eliminated. An activated carbon method, a combustion method and a scrubbing method were studied to remove O3. The operating variables, operating costs, and advantages of each method are reviewed. The selectiion of a particular method depends on the particular applicaton and on the ozone concentration in the waste gas. The activated carbon is the simplest and most reliable method; the combustion method is useful for waste gases containing high ozone concentrations; and scrubbing is suitable for waste gases containing low concentrations of ozone and a huge volume of effluents.

41384 **APTIC NO. 65006**

McCain, Joseph D. and Wallace B. Smith

LONE STAR STEEL STEAM-HYDRO AIR CLEANING SYSTEM EVALUATION (FINAL REPORT). *M. W. Kellogg Co., Houston, Tex., Environmental Protection Agency Contract 68-02-1308, Task 11, ROAP 21ADL-04, Program Element 1AB012, Rept. EPA-650/2-74-028, 42p., April 1974.*

NTIS: PB 232436/AS

Results of fractional and overall mass efficiency tests of the Lone Star Steel Steam-Hydro scrubber are presented. The tests were performed on one of seven modules of a full scale scrubber used for controlling particulate emissions from an open hearth furnace. Total flue gas particulate mass concentrations were determined at the inlet and outlet of the scrubber by conventional (Method 5) techniques. Inlet and outlet particulate concentrations as functions of size were determined on a mass basis using cascade impactors for sizes from about 0.3-5 micron and on a number basis for sizes smaller than about 1 micron using optical and diffusional methods. The collection efficiency of the air cleaning system was quite high, with values of 99.90 and 99.84% being obtained for two days of testing on a source producing particulates having a mass mean diameter of about 1 micron. Measured fractional efficiencies were about 90% at 0.01 micron, about 70% at 0.05 micron, 85% at 0.1 micron, 99.9% at 0.5 micron, 99.99% at 1 micron, and 99.6% at 5 micron.

41385 **APTIC NO. 65007**

McCann, C., J. Demeter, R. Snedden, and D. Bienstock

COMBUSTION CONTROL OF POLLUTANTS FROM MULTI-BURNER COAL-FIRED SYSTEMS (FINAL REPORT). *Bureau of Mines, Pittsburgh, Pa., Environmental Protection Agency Interagency Agreement EPA-IAG-020(D), ROAP 21ADG-81, Program Element 1AB014, Rept. EPA-650/2-74-038, 42p., May 1974.*

NTIS: PB 233037/AS

Results are presented from an investigation utilizing an experimental 500 lb/hr multi-burner pulverized-coal-fired furnace to determine the effects of several combustion modifications on nitrogen oxide emissions. Techniques investigated were: reduced excess air, staged combustion, flue gas recirculation to both primary and secondary combustion air streams, and combinations of all techniques. Reducing excess air from 20-2% reduced NOx emissions by about 70%; however, the NOx reduction was accompanied by a significant decrease in carbon conversion at the lower excess air levels. Staged combustion reduced NOx emissions by about 50%, with little increase in carbon loss over conventional combustion. Flue gas recirculation (30%) also reduced NOx emissions by about 50%, but it was accompanied by a significant reduction in carbon combustion efficiency, similar to that experienced in the low excess air tests. Various combinations of the individual reduction techniques were tested but did not offer any advantage since the effects were not cumulative.

41386 **APTIC NO. 63709**

McMullen, Gabrielle L.

HYDRAZINE AS AN ALTERNATIVE TO PETROLEUM. *PACE, 27(3):54-56, March 1974. 41 refs.*

The advantages and disadvantages of using hydrazine (N2N-NH2) as a fuel to replace fossil fuels are discussed. Since hydrogen may explode in the presence of heat and is toxic, it would have to be very carefully handled. Two commercial syntheses of hydrazine are available at present - the Raschig process and the urea process. The Raschig process is cheaper than the urea process at high levels of production. Hydrazine is currently available for about $2.40/kg, which makes it too expensive for use as a fuel in automobiles. A cheap, commercial synthesis of hydrazine based directly or indirectly on nitrogen may be possible in the future. Cheap production of electricity by breeder reactors or solar energy could allow the cheap production of ammonia from electrolysis of water followed by production of hydrazine. A hydrazine-fueled internal combustion engine has been designed, but a more attractive and efficient alternative is an electric car driven by a hybrid system consisting of a battery and a fuel cell. Hydrazine-air fuel cells look promising for the future. They have already been used in golf carts, lift trucks, and other applications. The waste products of the hydrazine-air fuel cells are not harmful -- nitrogen and water are returned to the environment. The efficiency of oxidation of the hydrazine hydrate is 60% compared with 20% for a similar fuel cell based on propane.

41387 **APTIC NO. 63780**

Meliere and Lowrance

ELECTROCHEMICAL PROCESS FOR THE ABSORPTION AND RECOVERY OF SULFUR DIOXIDE. *(Un procede electrochimique pour l absorption et la recuperation du gaz sulfureux). Text in French. Chim-Actualites, no. 1527-35-38, March 1974.*

The Stone and Webster-Ionics process for the absorption and recovery of sulfur dioxide from flue gases is described. The flue gas containing sulfur dioxide is scrubbed with sodium hydroxide solution for SO2 removal, after which the resulting sodium sulfite and sodium disulfite solution is mixed with sulfuric acid during which SO2 is liberated and can be recovered in the form of elemental sulfur on sulfuric acid. After treatment, the solution contains sodium sulfate which is then regenerated electrochemically in an electrolytic cells with anodes, cathodes, membranes, and diaphragms to separate sodium hydroxide solution and sulfuric acid that are then recirculated in the respective steps of the recovery process. The efficiency of the sulfur removal amounts to 95% or more, and the residual SO2 content in the flue gas does not exceed 50 ppm.

41388 **APTIC NO. 65902**

Mielenz, Richard C.

SPECIFICATIONS AND METHODS OF USING FLY ASH IN PORTLAND CEMENT CONCRETE. *Bureau of Mines Information Circ., no. 8640:61-74, 1974. 27 refs. (Presented at the International Ash Utilization Symposium, 3rd, Pittsburgh, Pa., March 13-14, 1973.)*

Fly ash is utilized in three general ways in the preparation of portland cement mixtures: As an admixture in concrete or mortar, as a pozzolan component of a blended hydraulic cement, and as a portion of the raw material used in the manufacture of portland cement. The rate of fly ash utilization in portland cement mixtures has increased over the years and can be expected to increase. The three ways of using fly ash are discussed along with specifications for fly ash (both chemical and physical requirements) in these mixtures. Fly ash and bottom ash represent a valuable source of material for use in manufacture of portland cement concrete, portland-pozzolan cement, and portland cement itself. Satisfactory and uniform results can be obtained by development and use of suitable specifications and quality control and quality assurance procedures in the production of the cement and concrete. The diversity of sources of fly ash in terms of types of coal, use of additives to the coal to accommodate air pollution standards, and variable conditions of operation of individual coal-burning facilities present problems in the promulgation of specifications and standards for use of the ash. In some instances, acceptance of the ash and decision on the manner of its use in portland cement concrete must be based upon tests of concrete mixtures proposed for use in specific work. (Author conclusions modified)

41389 **APTIC NO. 63755**

Miller, W. E.

THE CAT-OX PROCESS AT ILLINOIS POWER. *Chem. Eng. Progr., 70(6): 49-52, June 1974.*

A demonstration plant will soon begin a 15-month test for removal of sulfur dioxide from power plant stack gas by catalytic oxidation. Preliminary tests indicate that the goal of removing all the fly ash and at least 85% of the SO2 can be achieved. The SO2 is oxidized to 78% sulfuric acid which can be sold. Overall capital cost is $8.5 million. Operating and maintenance costs are expected to run $600,000/yr after the initial de-bugging period. Operation of the Cat-Ox system consists basically of the following six separate phases: fly ash collection, conversion of SO2 to sulfur trioxide, heat recovery, removal of sulfuric acid, acid mist elimination, and acid storage and loading. These steps are shown diagrammatically and described. The time schedule for the Cat-Ox System has had some delays. Hopefully, the system will return to operation by 1974 so that the 15-month test program is completed in mid-1975.

41390 **APTIC NO. 63878**

Minescu, F.

THE TECHNOLOGY OF HYDROCYCLONES. *(Technologia de exploatare a hidrocicloanelor). Text in Rumanian. Petrol Gaze, 25(4): 208-211, April 1974.*

A method for the calculation of the minimum diameter of the particles separated by a hydrocyclone has been devised. Hydrocyclones are used for the centrifugal separation of solid particles in suspensions. The separation of the particles in a suspension can be done using gravitational, centrifugal, and electrical forces, and a hydrocyclone uses all three, mostly centrifugal force. The minimum diameter of the particles separated by a hydrocyclone is 48.5 micrograms.

41391 **APTIC NO. 65900**

Minnick, L. John

MULTIPLE BYPRODUCT UTILIZATION. *Bureau of Mines Information Circ., no. 8640:44-55, 1974. 11 refs. (Presented at the International Ash Utilization Symposium, 3rd, Pittsburgh, Pa., March 13-14, 1973.)*

Although coal is a large energy source, it produces large quantities of fly ash, sulfur oxides, sludges, and bottom ash when burned. Over the last 30 years, considerable effort has been expended to develop uses for pulverized coal fly ash. These efforts are reviewed. Sulfur oxides can be removed from powerplant stack gas by scrubbing with limestone or lime absorbents, however, these systems produce no recoverable byproducts. Other methods produce sulfuric acid, gypsum, or elemental sulfur. Sulfopozzolanically active fly ashes obtained with lime or limestone treatment systems may be useful byproduct. New fly ashes and fly ash sludges may be used in many ways. A test program of multiple by-product utilization at an airport is reviewed. The sulfur oxide/sludge/stabilized fly ash was used to make the runway road bed. Sulfur oxide sludges from lime and limestone scrubbing were studied as components of road bases in another study. The sludge gave improved strength, dimensional stability, and reduction in permeability. It is believed that the stabilized mixtures can extend the utilization of fly ash and sludge in much larger tonnages. Various tests on synthetic aggregate are reviewed. Industrial and governmental considerations in by-product utilization are discussed.

41392 **APTIC NO. 63523**

Mockridge, P. C. and D. W. McDowell, Jr.

MATERIALS AND CORROSION PROBLEMS IN A FLY ASH SCRUBBING SYSTEM. *Mater. Performance, 13(4):13-17, April 1974. 1 ref.*

Corrosion in power plant scrubbing systems in caused by changes in the environment, improver materials and/or protective coatings, or unusual mechanical problems. Since the corrosive medium is principally weak sulfuic acid, high chloride content becomes an important factor, accelerating corrosion. Results of in-service tests of materials for scrubbing are discussed. The tests were conducted on a number of scrubbers designed for fly ash and/or sulfur dioxide removal. The adjustable venturi, the primary mist eliminator, the recycle pumps, the wet ID fans, the secondary mist eliminator, the reheat area, and the stacks are subject to corrosion under some conditions, therefore corrosion-resistant materials should be used. The results of two coated test spool tests showed the need for a protective coating. (Author abstract modified)

41393 **APTIC NO. 65863**

Montfoort, A. G.

THE CHEMICAL INDUSTRY AND THE TRANSFORMATION OF SOLID FOSSIL ENERGY CARRIERS. *(De chemische industrie en transformatie van vaste fossiele primaire energiedragers). Text in Dutch. Chem. Weekblad, 70(24):5-11, June 1974. 13 refs.*

The state of the art and trends in the transformation of coal into gaseous and liquid fuels are surveyed. Pyrolysis as applied in the coking and charring process, gasification, and liquefaction are the principal methods of coal transformation. Oil and powdered coke (char) are obtained from coal in the COED (Char Oil Energy Development) process. The gasification process is subdivided into individual steps, such as conditioning, oxidizing or hydrogenating gasification under increased pressure and at high temperature, cleaning from carbon dioxide and hydrogen sulfide as well as methanization and demethanization for synthetic gas or hydrogen. Coal can be liquefied by hydrogenation of a coal slurry in oil or water at a temperature of 450 C and under a hydrogen pressure of about 280 atm. In another method, the coal is subjected to extraction and the extract obtained is filtered and hydrogenated at 450 C and under 200 atm pressure. Coal gasification and liquefaction have the advantages of providing for an easily transportable fuel with high specific energy content which can be used as motor fuel, and which causes reduced amounts of water and air pollution during handling and combustion. Considerable reduction in the sulfur content can be achieved by gasifying or liquefying high-sulfur coals.

41394 **APTIC NO. 64396**

Moss, Gerald

REMOVING SULPHUR FROM HYDROCARBONS. *(Esso Research and Engineering Co., Linden, N. J.) U. S. Pat. 3,784,676. 17p., Jan. 8 1974. 10 refs. (Appl. April 30, 1971, 10 claims).*

A process for the removal of sulfur and other impurities from gaseous, liquid or solid hydrocarbon fuels using a fluidized bed or a fluidized bed boiler is described. Fluidized bed boilers improve the heat transfer between the source of heat and the object to be heated. A high proportion of the S and other impurities, especially vanadium compounds, are removed by reacting them with the fluidized bed material. Suitable material includes oxides of calcium, magnesium, and iron. The S may be regenerated from the solid sulfates, whether originally present or formed in the fluidized bed reactions. The sulfate can be decomposed, particularly in the presence of low concentrations of carbon monoxide, e.g., around 4% at temperatures in the region of 950 C. Sulfur dioxide is reduced to produce elemental S. The regenerated material may be reused to absorb further amounts of S. The yield of S can be increased in the presence of suitable catalysts at temperatures in the region of 250 C.

41395 **APTIC NO. 65764**

Nakai, Yoshiyuki and Tetsuya Yokogawa

PURIFICATION DEVICE FOR POLLUTION GAS. *(Osen kitai no seijo sochi). Text in Japanese. (Assignee not given.) Japan. Pat. Sho 49-29635. 4p., Aug. 12, 1974. (Appl. June 13, 1966, 1 claim).*

This gas purifier is a large square duct with a flared middle; the portion of the duct which begins to widen in a fan shape is the cleansing section compartmentalized by a number of metal screen mesh and three sets of water separation blinds. At the top are three liquid compartments with liquid supply tubes. The first liquid compartment contains an alkaline solution, the second an acid solution, and the third, water. The bottom of each compartment has a number of slits that are connected with the metal screens, and the liquid flows down along the screen forming liquid film curtains through which the gas will pass. The water separation blinds directly under the liquid chamber partitions are like venetian blinds, leading the cleansed air upward from the slits but letting the liquids flow down to the drainage compartments directly below the liquid compartment of each type. The cleaned air continues to move on the narrower portion of the duct.

41396 **APTIC NO. 64370**

Nakano, Michio

BASIC PLANS FOR AIR POLLUTION CONTROL METHOD IN OSAKA. II. *(Osaka-shi no taiki osen boshi kihon keikaku. II). Text in Japanese. Kagaku to Kogyo (Tokyo) (Chem. Chim. Ind.), 48(5):11-19, May 1974.*

The total liquid fuel consumption quantity; concentrations of sulfur oxides, nitrogen oxides, and particulate matter from fixed sources; and concentrations of carbon monoxide, NOx, and particulates from non-stationary sources are estimated for 1975, 1978 and 1981, based on the data for 1972. The pollutant concentrations in 1981 compared to those in 1972 are estimated to be 2.07 times larger for CO, 2.04 times for NOx, 2.06 times for hydrocarbons, and 1.97 times for particulates. Control measures for sulfur dioxide are conversion to low sulfur fuel containing less than 0.2% S and desulfurization processes. Nitrogen oxides control measures are conversion to low nitrogen fuel (estimated 20-60% reduction), burner modification, exhaust gas recirculation method, two-stage combustion, a combination of two-stage combustion and recirculation, denitration, and relocation of pollutant sources. The control program for the 1972-1981 period and the estimated reduction in pollutant concentration are shown in tabular forms. The case study of control measures by means of the fuel conversion, relocation of industries, and modification in the equipment and procedures are described with estimated reduction figures. The control measures for automotive emissions are based on the direct method of reducing emission quantity and indirect method of reducing the traffic volume. The control programs in compliance with the 1973, 1975, and 1976 control standards are described with case studies. The environmental pollution monitoring system and source pollution monitoring system are to be reinforced as a part of the control programs.

41397 **APTIC NO. 64417**

Nakayama, Kanemitsu

NATURAL GAS USED AS FUEL FOR BOILERS FREE FROM PUBLIC NUISANCE. *(Mukogai boira nenryo to shiteno tennen gasu). Text in Japanese. Boira Gishi (Boilermen), 29(4):289-301, April 1974.*

At present the production of natural gas is about 1/2 of that of crude petroleum. The estimated amount of natural gas deposits, however, will eventually surpass those of crude petroleum. Natural gas generally refers to natural combustible gas of which the principal component is hydrocarbon, with methane comprising 80% of natural gas. Gas chromatography is widely used to analyze elements of natural gas since it is highly sensitive, exact, and easily handled. The characteristics of natural gas are presented. The major domestic production areas are concentrated in the Tohoku District centering on Niigata Prefecture and the Southern Kanto District including Chiba Prefecture, the former occupying 76% of total domestic production. Today 2/3 of primary energy consumed domestically consists of crude petroleum. Japan will have to depend on overseas crude petroleum for 3/4 of the total energy consumption in 1991. A switch from crude petroleum into a new source of energy is urgent in terms of prevention of air pollution. Natural gas will inevitably replace crude petroleum in that sense.

41398 **APTIC NO. 65885**

Nebel, Carl and Paul C. Unangst

OZONE FOR POLLUTION CONTROL. *Int. Pollut. Control Mag., no. 1:28-31, 126-127, 1974 (?).*

Ozone is a powerful oxidant and disinfectant. It can be used in treating municipal and industrial effluents and in eliminating undersirable odors. Pathogenic bacteria and viruses are rapidly killed by ozone, and water quality is greatly improved. Although used for nearly 70 years, the full potential of ozone for pollution control is only currently being realized. The uses of ozone, methods for ozone production, and economic and safety factors in ozone use are reviewed. (Author conclusions modified)

41399 **APTIC NO. 63696**

Nekrich, Y. M. and G. V. Khrapal

PURIFICATION OF LOW-CONCENTRATION WASTE GASES CONTAINING NITROGEN OXIDES. *(Ochistka nizkokontsentrirovannykh otkhodyashchikh gazov, soderzhashchikh okisli azota). Text in Russian. Khim. Prom. (Moscow), no. 3:203-205, 1974. 13 refs.*

The adsorption of low concentrations of nitric oxide and nitrogen dioxide in waste gases on common and acid-proof zeolites was studied in dynamic tests. The dynamic capacity of the zeolite type of sodium compounds decreased with increasing gas flow rate at the same nitrogen oxide concentration. Each regeneration resulted in a reduction of the adsorption capacity due to the destruction of the crystalline structure of the zeolite in acidic medium. Acid-proof adsorbents such as mordenite and erionite preserved their adsorption capacities for a long time for 0.03% NO, but their capacity reduced rapidly at a higher concentration of 0.47%. Acid-proof zeolites with high adsorption capacity can be used to obtain concentrated NO2 or nitric acid from waste gases with low NO concentrations.

41400 **APTIC NO. 64056**

Newhall, Henry K.

LOW EMISSIONS COMBUSTION ENGINES FOR MOTOR VEHICLES. *Preprint, American Chemical Society, Washington, D. C., 24p., 1974. 29 refs. (Presented at the American Chemical Society Meeting, Los Angeles, Calif., March 31-April 5, 1974.)*

The underlying concepts and current status of unconventional engines using modified combustion as means of emissions control are reviewed. Modified combustion engines can yield large reductions in vehicle exhaust emissions. Such modifications include stratified charge engines of both open and dual chamber design. On an experimental basis, prototype stratified charge engines achieve low exhaust emissions with fuel economy superior to that of conventional engines controlled to similar emissions levels. The diesel engine is capable of achieving low levels of light hydrocarbon, carbon monoxide, and nitrogen oxide emissions with excellent fuel economy. Potential problems associated with widespread diesel use in light duty vehicles are initial cost, large engine size and weight for a given power output, the possibility of excessive particulate and odorant emissions, and excessive engine noise. Several power plants based on continuous combustion processes have the potential for very low exhaust emissions. These include the gas turbine, the Rankine engine, and the Stirling engine. There are major problems in the areas of manufacturing costs, reliability, durability, vehicle performance, and fuel economy. (Author conclusions modified)

41401 **APTIC NO. 64393**

Nicklin, Thomas and Frederick Farrington

TREATMENT OF GASES AND LIQUIDS. *(The Gas Council, London (England)) U. S. Pat. 3,784,465. 4p., Jan. 8, 1974. 3 refs. (Appl. July 27, 1972, 10 claims).*

A process for removing sulfur compounds from gases or liquids is described. The gases or liquids are steam desulfided in the presence of a catalyst containing an uranium oxide together with a thorium oxide and/or a cobalt oxide to form hydrogen sulfide. Air may also be present. The process is useful for desulfiding inorganic gases as effluent gases and for desulfiding organic compounds such as oils. (Author abstract modified)

41402 **APTIC NO. 63855**

Nitzsche, Hans Georg and Heinz Kessel

HONEYCOMB TYPE CERAMIC CARRIERS FOR CATALYTIC AFTERBURNING UNITS. *(Wabenfoermige keramische Traegerkoerper in katalytischen Nachverbrennungsanlagen). Text in German. Glas-Email-Keramo-Tech. 25(3):41-45, March 1974. 5 refs.*

Honeycomb-like ceramic catalyst carriers with a large specific surface and low flow resistivity are used in stationary and movable catalytic gas-decontamination units. There are some geometrical and material varieties of the honeycomb-like ceramics. It is possible to intermix activated substances with the basic material. Material data, for example, pore volume, pore size distribution, and specific surface, can be adapted to the requirements in a wide range. The hexagonal shape of the individual body allows reaction vessels of any dimension and shape to be used.

41403 **APTIC NO. 65914**

Nowak, Zygfryd

IRON AND ALUMINA EXTRACTION FROM POWERPLANT FLY ASH IN POLAND. *Bureau of Mines Information Circ., no. 8640:224-230, 1974. (Presented at the International Ash Utilization Symposium, 3rd, Pittsburgh, Pa., March 13-14, 1973.)*

Research work carried out in the field of fly ash utilization resulted in methods for the extraction of iron oxides and aluminum oxides from powerplant fly ash. The processes were proven on pilot plant and demonstration plant scale, and showed reliability and positive economic results. Consideration is given to the construction of industrial plants for the extraction of these metals from fly ash. The extraction process is described. It consists of treating the fly ash from powerplants as a potential source of artificial magnetite and extracting the iron oxides by electromagnetism. A sintering-disintegration or an acid method is used to extract the aluminum. (Author conclusions modified)

41404 **APTIC NO. 65767**

Okamura, Mamoru

AIR CLEANER. *(Kuki seijoki). Text in Japanese. (Sharp Co. Ltd., Osaka (Japan)) Japan. Pat. Sho 49-29634. 2p., Aug. 12, 1974. (Appl. March 30, 1970, 1 claim).*

Unlike previous filter-type air cleaners, this invention contains a filter and a total freezing cycle comprising an evaporator, a condenser, and an air compressor. The air suction entrance is located on the side of the outer case and the clean exit is located at the top. Inside, the case is divided by vertical walls and the casing is relatively small. The air containing dusts or odor is first cooled in the evaporator and vapor in the air forms dews; these are condensed by the condenser, then warmed back to the temperature of the air at the entrance. Therefore, the equipment eliminates humidity in the air. The air current is forced by a fan to change direction approximately 180 degrees when entering each section; therefore the distances between sections are relatively short but the divider completely shuts off the effect of radiation heat.

41405 **APTIC NO. 64323**

Orr, J. and J. R. Fletcher

STEELS FOR EXHAUST-EMISSION-CONTROL SYSTEMS. *Sheet Metal Ind. (London), 51(5):240-245, May 1974.*

A test rig was designed and used to expose steel samples to exhaust gases produced by a gasoline-driven engine. The rig was used to compare the oxidation/corrosion rates of various steels in the exhaust gas, simulating the operating conditions of emission control systems. The design and operating procedure for the test rig are described. The rig uses a 14-hour running cycle with two separate sections - the first taking 7 hr at a generator speed of 600 rev/min. Mild steel, aluminized steel, 12-24% chromium ferritic stainless steels, austenitic stainless steels, and heat-resistant alloys were tested at temperatures from 700 to 1100 C with exhaust containing different amounts of carbon monoxide, carbon dioxide, oxygen, and other substances from engines operating under various operating modes. Preliminary results are presented for the steels tested at 700 C. The steels oxidized at a faster rate under the simulated conditions of an exhaust emission control system operating at 700 C than in air due to the cyclic temperature operation used in the test rig. (Author abstract modified)

41406 **APTIC NO. 65856**

Oshima, Ikuji and Tetsushiro Sarutani

DEODORIZATION CATALYSTS. *(Dasshuyo shokubai). Text in Japanese. (Taihei Bussan Co., Akita (Japan)) Japan. Pat. Sho 49-27035. 3p., July 13, 1974. (Appl. Aug. 14, 1967, 1 claim).*

A deodorizing catalyst is described that is especially effective for removal of albuminide nitrogen compounds when the degradation of protein occurs, such as in the putrefication of fish and meat, excretion, and drying of chicken feces. Albuminide nitrogen compounds are effectively degraded by copper-aluminum hydroxide catalysts. For preparing this catalyst, copper and aluminum chips (weight ratio 1:05-2) are dissolved in nitric acid or hydrochloric acid, and excess acid is driven out. Then 9-12 times the amount of the copper-aluminum combination of some carrier material such as ceramic clay, zeolite powder, diatoms, or bentonite are added and mixed well; pH is adjusted to 5.5 to 6.5. The mixture is heated to 70-90 C and 20-40% alkaline solution is added gradually until the pH increases to 9-10. Copper hydroxide and aluminum hydroxide precipitate on the carrier. After washing the sedimentation several times, the substance is dried in the air and molded into appropriate shape. The optimum size of the catalyst particles are particles extruded through 2 mm holes and sifted through 10 mesh. The dry catalyst is reduced in hydrogen for 2 hrs at 150-350 C, and oxidized in oxygen or air.

41407 **APTIC NO. 63694**

Ostrovskiy, O. P., Y. N. Reznikov, Y. I. Tselukyo, and Y. I. Chander

CLEANING OF FLUE GASES GENERATED DURING THE BURNING OF MAGNESIUM HYDROXIDE. *(Ochistka dymovykh gazov pri obzhige gidrookisi magniya). Text in Russian. Ogneupory (USSR), no. 5:21-26, 1974. 5 refs.*

A method for the prevention of incrustations in the flue gas ducts and electrostatic dust precipitators after rotary kilns used for the burning of magnesium hydroxide obtained from salt water is described. The formation of the incrustation which inteferes with the functioning of the electrostatic dust precipitators is due to the presence in the magnesium hydroxide of sulfur and chlorine, as well as of sulfur, vanadium, and alkali metals in the ashes of the fuel oil burned. It was possible to prevent such incrustations by adding a liquid additive to the fuel oil at a rate of 0.5-0.7%.

41408 **APTIC NO. 65906**

Peabody, Terry E.

FLY ASH PRODUCTION AND UTILIZATION IN AUSTRALIA. *Bureau of Mines Information Circ., no. 8640:106-113, 1974. 4 refs. (Presented at the International Ash Utilization Symposium, 3rd, Pittsburgh, Pa., March 13-14, 1973.)*

The history of fly ash use in Australia is discussed. When fly ash was first investigated in 1950, it was found to exhibit pozzolanic properties. Then fly ash was used in construction of a concrete dam, and other concrete structures and as an ingredient in paving material. In 1972, production of fly ash was 2,360,000 tons from bituminous and subbituminous coal and 174,000 tons from lignite coal. The Australian and American standards for fly ash and blended cements are compared, Australian fly ash composition is reviewed, and sources of fly ash in various parts of Australia are discussed. The current marketing and utilization situation in Australia is described.

41409 **APTIC NO. 65899**

Pedlow, J. Watson

CENOSPHERES. *Bureau of Mines Information Circ., no. 8640:33-43, 1974. 6 refs. (Presented at the International Ash Utilization Symposium, 3rd, Pittsburgh, Pa., March 13-14, 1973.)*

Cenospheres are hollow spheres such as microballoons used to form a floating barrier on the surface of oil to minimize fuel evaporation. Organic-based microballoons of foams are used as a core material in sandwich foams to reduce flexibility of reinforced plastics. Fly ash cenospheres are formed in increasing proportion as ferric oxide content increases according to one study. Another study of fly ash from power stations showed high cenosphere amounts in fly ash with high amounts of silica and alumina and low amounts of iron oxide. The properties of cenospheres are discussed including their formation, size, and chemical composition. The use of fly ash cenospheres in industrial applications is reviewed. They can be used in various types of insulation, in ceramic mufflers for automobile emission control, and in other types of linings. Instant turf can be made by placing a layer of pulverized fly ash cenospheres combined with other floating material on water in a shallow pond tank. On this is placed a carrier sheet and a mixture of fertilizer and grass seed. The seed germinates and produces a good growth of grass which ties the whole layer together.

41410 **APTIC NO. 65870**

Plass, William T. and John P. Capp

PHYSICAL AND CHEMICAL CHARACTERISTICS OF SURFACE MINE SPOIL TREATED WITH FLY ASH. *J. Soil Water Conserv., 29(3):119-121, May-June 1974. 4 refs.*

The use of power plant fly ash for surface mine reclamation offers an attractive outlet for large tonnages of this waste material. Research by the Bureau of Mines beginning in 1963 showed that fly ash could be used to neutralize extremely acid surface mine spoil. The treatments favored establishment of grass and legume cover by modifying chemical and physical characteristics of the spoil. Changes that occurred in a spoil following the application of 150 tons of fly ash per acre are described. The treatment neutralized acidity, added plant-available phosphorus, lowered spoil density, and increased subsurface moisture. The chemical composition of fly ash indicated that other essential plant nutrients were also added. At lower depths, fly ash plots consistently recorded more accumulated soil moisture. Fly ash treatment increased infiltration rates, increased soil porosity, and increased percolation to a depth of 4 ft. Moisture at this depth could provide a reserve for deep-rooted plants during times of moisture stress. (Author abstract modified)

41411 **APTIC NO. 64385**

Ploeckinger, F.

WASTE GAS CLEANING METHODS. *(Abgasreinigungsanlagen). Text in German. Oesterr. Ing.-Z., 17(7):240-242, 1974.*

The main emphasis of waste gas cleaning in the past was placed on the removal of solid components from waste gases. Now that collection efficiencies of 99.9% have become feasible with dust collectors, more emphasis is being placed on the removal of gaseous components. A brief review of the main features of mechanical dust collectors, scrubbers, electrostatic precipitators, and dust filters is given. For the removal of gaseous components scrubbers can be used in theory. However, no scrubbing method is known today which would permit an economical removal of the gaseous pollutants from large quantities of off-gases. For smaller plants a neutralization of the scrubbing fluid can be carried out but again only with high costs and a collection efficiency of only about 70%.

41412 **APTIC NO. 63680**

Porsche, H.

MODERN QUARRY PLANT. *(Moderner Steinbruchbetrieb). Text in German. Aufbereitungs Technik, 15(6):281-285, 1974.*

A detailed description is given of the primary crushing section, including intermediate bin storing of the reduced material, for a broken-stone processing plant. For dust collection, a tubular bag filter is used which is cleaned by vibration and reverse air jet. Through variation of the intervals between rapping and the rapping duration of the filter can be adjusted to various operating conditions. The filter requires no maintenance, and all movable parts received permanent lubrication.

41413 **APTIC NO. 65810**

Prather, R. J. and S. Miyamoto

NITRIC OXIDE SORPTION BY CALCAREOUS SOILS: III. EFFECTS OF TEMPERATURE AND LACK OF OXYGEN ON CAPACITY AND RATE. *Soil Sci. Am. Proc., 38(4):582-585, July-Aug. 1974. 12 refs.*

Surface samples of three calcareous soils from southern Arizona were studied to determine their ability to adsorb nitric oxide under different conditions of temperature, oxygen, and humidity. The sorption of NO by oven-dry soils from dry air (relative humidity less than 5%) containing a concentration of 1.5% NO by volume decreased exponentially with increasing temperature from 24 to 120 C. From a moist stream (relative humidity greater than 95%), both NO and water sorption capacities and rates decreased with increasing temperature from 24 to 77 C. The sorption capacity of NO relative to H2O changed little, while the relative sorption rate to that of H2O decreased markedly when the temperature increased from 24 to 36 C, but not for higher temperatures. The lack of gaseous oxygen severely inhibited the sorption of NO from both dry and moist nitrogen gas streams. Calcareous soils could be used to adsorb NO from waste gases. (Author abstract modified)

41414 **APTIC NO. 64395**

Ranft, Ernst L. and William F. Thornburgh

EXHAUST GAS RECIRCULATION VALVE. *(General Motors Corp., Detroit, Mich.) U. S. Pat. 3,783,848. 6p., Jan. 8, 1974. 4 refs. (Appl. Dec. 13, 1972, 5 claims).*

A diaphragm operated control valve assembly is described which is responsive to exhaust back pressure. It controls recirculation of exhaust gases from the intake manifold induction passages. The back pressure signal is applied through a restrictive orifice in a passage formed in the valve stem. A screen disposed above the diaphragm prevents any ice formed on the diaphragm cover from dislodging to cause malfunction of the valve assembly. Improvements over prior valve assemblies include a restrictive orifice to dampen variations in exhaust back pressure and the screen to prevent the ice from dislodging. (Author abstract modified)

41415 **APTIC NO. 63688**

Rasch, Rudolf

THERMAL DISPOSAL OF REFUSE UNDER EXCLUSION OF AIR. *(Thermische Muellbehandlung unter Luftausschluss). Text in German. Chemiker-Ztg. (Heidelberg), 98(5):253-260, May 1974. 26 refs.*

Thermal disposal of refuse without air can be accomplished by pyrolysis or degasification, hydrogenation, and oxidizing gasification or destructive distillation. These three processes should be conducted so that the condensing hydrocarbons will be cracked into low molecular gases during the process. In this way, any difficulties due to hard tar will be avoided. The gasification of solid waste in direct current is suited for medium areas which are too small for incineration of garbage. The degasification of solid waste is a nonpolluting method of treating waste.

41416 **APTIC NO. 63437**

Rayna, J.

DUST SEPARATION FROM AND PURIFICATION OF INDUSTRIAL PROCESS GASES. *(Depoussierage et epuration des gaz de procedes industriels). Text in French. Tech. Moderne, 66(4):24-27, April 1974.*

Different types of dust separators and their applications for dust separation from and purification of industrial process gases in a fertilizer manufacturing plant, a pyrite roasting plant, and a waste incinerator plant are described. Cyclones, the simplest type of dust separators, separate dust from waste gases by tangential admission of the latter that are forced to contact water droplets along their helicoidal path. The accelerated waste gas jet is used to pulverize the wash liquid in venturi scrubbers that are composed of a venturi tube and a cyclone type separator. Venturi scrubbers can be combined with cyclones or plate-type adsorber columns. Plate-type dust separators have efficiencies of 80-98%, depending on the type of plates used.

41417 **APTIC NO. 65915**

Rehsi, S. S.

STUDIES ON INDIAN FLY ASHES AND THEIR USE IN STRUCTURAL CONCRETE. *Bureau of Mines Information Circ., no. 8640:231-245, 1974. 33 refs. (Presented at the International Ash Utilization Symposium, 3rd, Pittsburgh, Pa., March 13-14, 1973.)*

The characteristics of Indian fly ashes and their use in structural concrete are discussed. Compared to fly ash from other countries, Indian fly ash has higher silica, alumina, and unburned fuel and lower ferric oxide, sulfite, and spheroidal glass content. It is comparatively coarser and has an increased water requirement for a given degree of workability of cement mortar or concrete. While no correlation was found between the lime reactivity and the content of silica or silica plus alumina or the specific surface of these fly ashes, a definite trend of increase in lime reactivity with an increase of passing a 44 micron sieve was evident. The fly ash concrete which was proportioned to attain, at 28 days, structural properties similar to those of the corresponding plain cement concrete, provided equal protection to steel reinforcement against corrosion; the apprehension of enhanced corrosion of steel reinforcement due to incorporation of chlorides, sulfates, and unburned carbon in it was ill-founded. The particle shape, pozzolanic activity, chemical and mineralogical composition, and particle size are discussed. (Author conclusions modified)

41418 **APTIC NO. 63779**

Reynaud, Paul

THE USE OF FLUE GAS NEUTRALIZING ADDITIVES AT THE STEAM GENERATORS OF THE MONTEREAU POWER PLANT. *(Utilisation d additifs pour neutraliser les fumees provenant de la combustion du fuel dans les generateurs de vapeur de la centrale de Montereau). Text in French. Rev. Gen. Thermique (Paris), 13(14):235-244, March 1974.*

Experiments carried out at the Montereau power plants firing heavy fuel oil with 3-4% sulfur with magnesia and ammonia as additives for the neutralization of the sulfur dioxide-containing flue gases are described. The addition of magnesia in the fuel, though not suppressing the corrosion of the cold parts of the boilers and heat exchangers, limited the corrosion to 1 g/sq m/hr. The use of dosage and magnesia presented certain inconveniences, e.g., rapid wear of the burner plates. Magnesia could be used, however, in cases when ammonia injection was not feasible, e.g., in regenerative air reheaters. Due to its better anticorrosive action, gaseous ammonia injection at a rate of 80 kg/hr is currently used in the 250,000 kW unit. The ammonium sulfate obtained is removed from the air reheater surfaces, and it is removed from the flue gas by means of electrostatic precipitators.

41419 **APTIC NO. 64402**

Robertson, John A.

APPARATUS AND METHOD FOR ELECTRICAL PRECIPITATION. *(The Mead Corp., Dayton, Ohio) U. S. Pat. 3,785,118. 5p., Jan. 15, 1974. 5 refs. (Appl. March 22, 1972, 10 claims).*

A liquid spraying electrical precipitator consisting of a pair of electrically conducive walls and a plurality of spouts on each wall is described. A cleaning liquid such as water is applied to one of the walls and flows down into spouts. The liquid covers the gap between the walls by application of a strong electrical field. It causes negatively charged drops to be sprayed from the spouts on the first wall, and to follow a somewhat downwardly directed trajectory until they impinge upon the second wall. Water impinging on the second wall runs downwardly to spouts and is resprayed as positively charged drops across the gap to the first wall. This process is continually repeated until the water finally exits at the bottom of the precipitator. Other precipitators are characterized by either electrical field precipitation or charged particle precipitation, but not both. (Author abstract modified)

41420 **APTIC NO. 63674**

Roehm, Werner

EXPERIENCES WITH THE OPERATION WITH LIQUID NATURAL GAS. *(Erfahrungen beim Fahrbetrieb mit Fluessigerdgas). Text in German. Gas Wasserfach, Gas/Erdgas (Munich), 115(7):321-322, 1974.*

A Daimler Benz truck has been in operation with liquid natural gas since January 1973 and has since covered 8000 km under different conditions. The gas engine of the type M352 G showed no negative changes at a close inspection. The carbon monoxide concentration climbed to more than 1%. Through installation of a bypass this value was reduced to 0.6%. The concentration of the other pollutants remained very low and were in general below the California emission limits for 1975.

41421 **APTIC NO. 64317**

Sachse, J. and N. Jaskulla

GAS - A NON POLLUTING FUEL FOR COMBUSTION ENGINES. *(Gas - ein umweltfreundlicher Kraftstoff fuer Verbrennungsmotoren). Text in German. Technik (Berlin), 29(6):389-392, June 1974.*

In the Soviet Union particularly in Moscow, Leningrad, Kiev, Volgograd, Taschkent, Baku and Minsk, a large number of automobiles will be switched to gas operation over the next few years. Within the period 1974 and 1976 35,000 trucks, cabs, and buses shall be switched to gas operation. Presently 2000 automobiles run with gas in Moscow. Liquefied petroleum gas is a methane-free mixture of primarily propane (at least 28 percent) and butane (65 per cent at the most) which is liquid at a pressure of 25 kg force/sq cm and room temperature. Natural gas contains primarily methane (95 percent). The densities of liquefied petroleum gas and natural gas are lower than that of gasoline, and the heating values only slightly higher. The liquefied gas tank must be pressurized and thus four to five times larger than the gasoline tank for the same quantity of power. Natural gas is also carried along in liquefied form for reducing the danger of explosion. The tank for liquid natural gas requires excellent heat insulation. The switch of Otto engines to gas operation requires only changes of the fuel system, for diesel engines the compression ratio must be lowered from 16 to 11, an ignition system installed instead of the injection pump, and the injection nozzles must be replaced by spark plugs. Other possibilities are fuel gasification in the gas generator or the hybrid operation between liquefied gas and diesel fuel. The switch of a gasoline engine to gas operation means a reduction of emissions. With the liquefied petroleum gas engine the carbon monoxide emission is reduced. The reduction rates of CO, hydrocarbon, and nitrogen oxides increase even more with natural gas operation and are largest for the Otto engine with gas generator. The use of any one of these methods in the future will depend on the costs and on the maturity of development.

41422 **APTIC NO. 65832**

Sachse, J. and N. Jaskulla

GAS - AN ENVIRONMENTALLY EXCELLENT FUEL FOR INTERNAL COMBUSTION ENGINES. *(Gas - ein umweltfreundlicher Kraftstoff fuer Verbrennungsmotoren). Text in German. Technik (Berlin), 29(6):389-392, June 1974.*

The technological and environmental advantages involved in the use of liquefied petroleum gas (LPG) and natural gas as fuel in spark-ignition and diesel engines are described. The conversion of available engines to gas is rather simple, while the installation of the tank is fairly expensive. Engines powered by LPG or natural gas provide for homogeneous mixture and nearly complete combustion, and have the advantage of emitting no lead, sulfur dioxide, or soot, as well as having substantially reduced quantitites of smog-forming components with photochemical activity, and practically no carcinogenic substances. The odor intensity of gas-powered engine exhaust is about half that of gasoline engine exhaust. Also the carbon monoxide, hydrocarbon, and nitrogen oxides emissions are substantially lower for gas engines than for gasoline engines. The CO concentration in LPG-powered engine exhaust is usually smaller than 0.3% by volume. Compared with gasoline and diesel exhaust, the exhaust gases of gas engines are less irritative, and the hydrocarbon emissions less toxic.

41423 **APTIC NO. 63843**

Sakabe, Osamu

LOW SULFUR PROGRAMS. *(Teiioka taisaku ni tsuite). Text in Japanese. Aromatikkusu (Aromatics), 26(3):1-10, 1974. 39 refs.*

Sulfur oxides control by reduction in sulfur content in fuel oils is discussed. The amount of imported crude oil with less than 1 wt% S content was increased from 9.8% in 1971 to 24.7% in 1972, and average S content was reduced from 2.00 wt% to 1.46% in 1972. The possibility of extending this trend in imported crude oil is rather slim, and further reduction in S content depends on technological measures. The presently employed control measures, the desulfurization of heavy oil, and desulfurization of exhaust gases are described and evaluated. Various processes of possible use in future desulfurization techniques are as follows: the direct desulfurization of residual oils, decomposition desulfurization of residual oils, pyrolysis (which includes steam pyrolysis and other methods), hydrogenation decomposition (which includes BOC isomax method), H-oil method and coal liquefaction method, gasification desulfurization of residual oils (which includes partial oxidation, combination of partial oxidation and pyrolysis), and desulfurization and denitration of exhaust gases (which include non-selective reduction method, selective reduction method, wet absorption method, and reduction absorption method). Procedures for each method are described and evaluated.

41424 **APTIC NO. 65796**

Sakol, S. L. and R. A. Schwartz

CONSTRUCTION MATERIALS FOR WET SCRUBBERS. *Chem. Eng. Progr., 70(8):63-68, Aug. 1974. 10 refs.*

If pilot tests and past experience cannot be used in determining optimum construction materials, the best alternative is to fabricate the scrubber from slightly higher quality materials than believed necessary. The construction materials for tray, venturi, and other types of wet scrubbers are discussed. The considerations for selecting construction material are the system temperature and pressure, process velocities, material characteristics, presence of trace components, and safety. A list of construction materials is given with industrial use, type of gaseous emission to be controlled, and type of scrubbing unit and medium.

41425 **APTIC NO. 65855**

Sato, Seitaro

DEODORIZATION SYSTEM FOR EXCRETION COLLECTION CART. *(Shinyo kumitoriguruma no shoshu sochi). Text in Japanese. (Santoku Chemical Engineering Co., Miyagi Township (Japan)) Japan. Pat. Sho 49-27941. 3p., July 22, 1974. (Appl. Dec. 22, 1966, 1 claim).*

A deodorizer attached to excretion collection carts for the treatment of bad odor that is emitted when excretion is collected by suction is described. At the bottom end of the deodorizer is a three-way cock, which lets the gas into two small chambers or opens up to the by-pass pipe. The gas entering the chamber raises the valve and enters the deodorization compartment which is made of a central tube and concentric tubes with narrow gaps where the gas passes. The gas from the central tube is forced to descend and enter a flat ring chamber which has nozzles with porous caps. The gas goes through the liquid deodorizer composed of inorganic acid, organic acid, metallic salt, aldehydes, and ketone and collides with a baffle board with a pitch which creates a whirlpool. After a good contact, the gas will then go through a funnel shaped cyclone demister. The exit of the demister and the three-way cock at the bottom are connected with a by-pass pipe, which is opened when discharging the compressed air in the collection tank after all the excretion has been unloaded, without letting the deodorizing liquid overflow.

41426 **APTIC NO. 63730**

Schene, H.

CLEAN AIR MAINTENANCE IN SURFACE COATING. *(Luftreinhaltung in der Lackiertechnik). Text in German. Werkstattstechnik, 64(5):282- 287, May 1974.*

Techniques for and problems of clean air maintenance in the surface-coating industry which emits lacquer particles and solvent vapors are surveyed. In the dip-coating process, associated with solvent concentrations over 4000 mg/cu m, air cleaning and subsequent solvent recovery are possible by adsorption on activated carbon. For lower concentrations, adsorption with subsequent desorption and thermal incineration at 600-1000 C are possible. The vent air from spray-coating shops can be purified by dry filters, such as glass-fiber filters, or wet type separators at efficiencies amount to 95-99%. The waste gases from drying furnaces can be cleaned by droplet separators, activated carbon adsorbers, venturi scrubbers, and electrostatic precipitators, and possibly combinations of equipment.

41427 **APTIC NO. 63969**

Schowalter, K. A. and N. S. Boodman

THE CLEAN-COKE PROCESS FOR METALLURGICAL COKE. *Chem. Eng. Progr., 70(6):76-82, June 1974.*

A new carbonizing/hydrogenating method for making coke is discussed which does not have the pollution problems associated with conventional coke oven techniques and which will produce a wide range of chemicals. Studies were undertaken to manufacture blast-furnace coke with a minimum of atmospheric pollution using high-sulfur, high-ash coals that are not normally suitable for coke making. The resulting products include low-sulfur liquid and gaseous fuels and byproducts. The coal carbonization and hydrogenation portions of the plant are described, and chemical products are discussed. A plant constructed to process 6.5 million tons/yr of as-mined coal would annually produce 2.2 million tons of coke pellets, 2.3 billion lbs of chemicals, 8 million gal of liquid fuels, and approximately 6 trillion Btu of fuel gas with this process.

41428 **APTIC NO. 63963**

Schutz, H.

AIR POLLUTION CONTROL IN HEAT-TREATING DEPARTMENTS. *(Lutte contre la pollution de l air dans les ateliers de trempe). Text in French. Trait. Therm., 83(74):47-53, March 1974.*

Air pollution control in metallurgical heat treatment departments in order to protect the personnel, the equipment, as well as the surrounding vegetation is discussed, and modern exhaust systems are described. The highest hazard is represented by the use of steel tempering, cementation, nitrification, and carbonitrification baths, containing cyanides, alkaline chlorides, alkaline oxides, alkaline terreous chlorides, nitrates, and alkaline hydrides. Installations with efficient suction for air pollution control in heat treatment departments are illustrated.

41429 **APTIC NO. 63677**

Schwanecke, Rudolf

ADVANCE CALCULATION OF DUST COLLECTORS. *(Vorausberechnung von Entstaubern). Text in German. Wasser Luft Betrieb, 18(7):381-386, 1974. 6 refs.*

In choosing filters, the approximate collection efficiency must be known at planning stage. For centrifugal separators, scrubbers, and electrostatic precipitators simple methods for advance calculation of the approximate collection efficiency are given and the most important design data for cloth filters are presented. In choosing dust collectors, knowledge of the composition and the grain size of the dust is important. The properties of the carrier gas such as composition, viscosity, and temperature must also be known. The fraction of different grain sizes of a dust, once it has been determined, is plotted in a nomograph in wt% as a function of the grain size. With the data of the specific dust collector and the nomograph the approximate collection efficiency can be estimated. Individual procedural calculation steps for the cyclone, the rotary flow collector, the wet collector, and the electrostatic precipitator are discussed.

41430 **APTIC NO. 64383**

Schwarzbauer, Gerd

REDUCTION OF OXIDES OF NITROGEN EMISSION BY AUTOMOBILE EXHAUSTS BY CONTROLLING ENGINE COMBUSTION. *(Abbau der Stickoxid-Abgasemission durch Steuerung der motorischen Verbrennung). Text in German. Motortech. Z. (Stuttgart), 35(8):255-258, 1974. 6 refs.*

The emission of oxides of nitrogen by automobile exhausts can be reduced through considerable increase of the turbulence in the combustion chamber and simultaneous ignition of the charge at several points in the combustion chamber. The most promising method for reduction of NOx is the stratified layer charge of which model cases are discussed. In the first case, the total charge is divided into a homogeneous fuel-to-air mixture and pure air. In the second case, a fuel-rich mixture is close to the ignition source and a lean mixture is used for the last stages of the combustion. A higher reduction of the nitric oxide emission is achieved with the first model. A lambda of 1.2 is to be avoided in this kind of combustion. A considerable reduction of NO emission can also be achieved by recirculation of about 20% of the exhaust gas. Recirculation of higher amounts of exhaust gas leads to deterioration of the combustion conditions (which are related to a drop of the medium pressure and an increase of the hydrocarbon emission). The NO reducing effect of exhaust gas recirculation rests primarily on a reduction of the heating value and not so much on the inert properties of the added exhaust gas.

41431 **APTIC NO. 66043**

Schweers W. H. M.

PHENOL PULPING--A POTENTIAL SULFUR-FREE PAPERMAKING PROCESS. *Chem. Technol., vol. 19:490-493, Aug. 1974. 15 refs.*

Pulping processes which use phenol instead of sulfur compounds are discussed. Conditions for phenol pulping of pine and beech and possibilities for the recovery of phenols from phenol lignin by pyrolysis were investigated. Satisfactory results were obtained using hydrochloric acid as the catalyst. Phenol pulping has several advantages. No inorganic pulping chemicals are needed; the process is sulfur free. The process is self-supporting in pulping chemicals. The only by-product is lignin coal obtained in the pyrolysis of phenol lignin which can be used as a fuel.

41432 **APTIC NO. 63698**

Seebach, E.

PERCOLATING BUBBLE ABSORBERS SOLVE THE PROBLEM OF WASTE GAS PURIFICATION IN THE LABORATORY. *(Sprudelabsorber loesen Abgasreinigungsprobleme in Laboratorien). Text in German. GIT (Glas. Instrum. Tech.) Fach. Lab., 18:356-357, 1974.*

A compact, high-efficiency percolating bubble absorber for the removal of harmful and toxic gases and vapors from the vent air in laboratories is described. The absorber, made of polyethylene, polypropylene, or polyvinylchloride, is composed of series- connected independent steps. The number of the steps is determined by the required purification efficiency that can amount to 100%. The wash liquid can be added either to the final step or to each step separately.

41433 **APTIC NO. 65908**

Selmeczi, Joseph G. and R. Gordon Knight

PROPERTIES OF POWERPLANT WASTE SLUDGES. *Bureau of Mines Information Circ., no. 8640:123-138, 1974. (Presented at the International Ash Utilization Symposium, 3rd, Pittsburgh, Pa., March 13-14, 1973.)*

Sludge produced from lime-sulfur dioxide scrubbing processes has unique characteristics that are not common with sludges produced in most waste water treatment, mineral processing, or chemical plants. The chemistry, crystallography, and crystal morphology of such sludges are reviewed to explain the behavior of the sludge material. Samples of sludges from various scrubbing systems operated on power plant and smelter flue gases were obtained, including lime, limestone, and double alkali scrubbing sludges. The quantity and chemistry of the fly ash component of the sludge depends on the type of coal burned and the efficiency of the fly ash removal system upstream of the scrubber. Some components of the fly ash and lime may act as catalysts and enhance the oxidation of sulfite to sulfate. The chemical analysis of specific sludges from lime and limestone processes, results of X-ray diffraction and particle size analyses on fly ash and sludge samples, crystal morphology of the sludges, settling and thickening characteristics of scrubber effluents, and results of laboratory centrifuge tests are discussed.

41434 **APTIC NO. 63469**

Semrau, Konrad

CONTROLLING THE OTHER SULFUR OXIDES SOURCES. *Preprint, American Chemical Society, Washington, D. C., 39p., 1974. 136 refs. (Presented at the American Chemical Society National Meeting, 167th, Symposium on Sulfur Removal and Recovery and Industrial Processes, Los Angeles, Calif., April 4-5, 1974.)*

The sources and control of sulfur oxides emission from industrial process or noncombustion sources are discussed. The most important process sources are primary copper, lead, and zinc smelters, Claus sulfur plants, sulfuric acid plants, coke plants, iron ore sintering and pelletizing plants, the regenerators of fluid catalytic cracking units, and sulfite pulp mills. Emission from Claus S plants will increase because of growing hydrodesulfurization of increasingly sour petroleum stocks and the desulfurization of coal for the production of clean, solid, liquid, and gaseous fuels. Control of SOx emissions from the industrial process sources is closely related to the technologies of the sources themselves, and changes in the process technologies may greatly improve the effectiveness and economy of emission control. The control processes currently used are described for each industrial process. (Author abstract modified)

41435 **APTIC NO. 65896**

Slonaker, John F. and Joseph W. Leonard

REVIEW OF CURRENT RESEARCH ON COAL ASH IN THE UNITED STATES. *Bureau of Mines Information Circ., no. 8640:26-32, 1974. 30 refs. (Presented at the International Ash Utilization Symposium, 3rd, Pittsburgh, Pa., March 13-14, 1973.)*

Current research conducted in the U. S. to increase the utilization of powerplant fly ash is reviewed. Field research is being done on fly ash for use as an agriculture fertilizer. Coal mine spoil and refuse bank reclamation with powerplant fly ash is also being studied; the fly ash served as a neutralizing agent, dilutent, and soil amendment to provide some nutrients which enhanced vegetation of the barren soils. Sintered fly ash can be used as an additive to soil to maintain low compaction density and increase the moisture-holding capacity of soil. Bricks containing 75% clay and 25% fly ash, asphaltic concrete using lignite fly ash as a filler, and highway asphalt with ash are being studied. Fly ash is also being tested for use in landfill to provide ease of handling and spreading, low compaction density, and high pozzolanic action. Boiler slag is being evaluated as a highway surface coating to decrease skidding accidents. Fly ash is also being studied for use in clay, load-bearing fill beneath highways, fire control, and pavement. Fly ash can remove phosphates and seal the bottom mud in algae-overgrown lakes to prevent water pollution. Other applications of fly ash cenospheres are listed.

41436 **APTIC NO. 65909**

Smith, Peter H.

LARGE-TONNAGE USES OF PFA IN ENGLAND AND OTHER EUROPEAN COUNTRIES. *Bureau of Mines Information Circ., no. 8640:139-147, 1974. (Presented at the International Ash Utilization Symposium, 3rd, Pittsburgh, Pa., March 13-14, 1973.)*

The annual production of fly ash (PFA) is approximately 10 million tons in England. Commercial outlets for large volumes of PFA were needed to appreciably cut the disposal costs and help preserve the environment. The main outlet for PFA in England was imported fill for road construction projects and building sites. Other countries used PFA for concrete, cement, and brick manufacture. Serious developmental work was undertaken in England to investigate large volume uses for PFA. This preliminary work is reviewed. Fly ash has grown in use as a fill material, mainly for roads and building sites, in both France and England over the past few years. The PFA works in roads because it is lightweight, stable, easy to handle, has low active pressure, causes negligible settlement, and causes less settlement below PFA. Cement-stabilized PFA is used for bases to both roads and car parks and as a premixed grouting material. Approximately 400,000 tons of PFA mixed with chalk and gypsum were used on the Hordain/Belgium frontier section for a 36 km subbase of a road. A PFA mixture was also used on the A27 Trunk Road in Avisford, West Sussex, England. The advantages of PFA as a structural fill on building sites are outlined including high load-bearing capacity, handiness for trenching, ease of compaction, and harmlessness to pipes. The handling of PFA at the site and precautions for PFA as a road and structural fill are also discussed.

41437 **APTIC NO. 64401**

Smitherman, John B.

POLLUTION CONTROL APPARATUS FOR SMOKE EMITTER. *(Assignee not given.) U. S. Pat. 3,785,126. 5p., Jan. 15, 1974. 13 refs. (Appl. Nov. 5, 1970, 1 claim).*

An apparatus for controlling the pollution in a smoke emitter is described. Ducts route the smoke past a smoke detector and through a water spray and eventually emerge beneath the water in a water holding basin. Unlike other apparatus, this device is relatively simple and easily adaptable to present smoke emitters. It does not require fans or blowers since the smoke is routed through the ductwork by the pressure of the emitter and by pressure exerted by the water spray. It does not need the floats and valves of other devices which add to the expense and maintenance of the system. An additional improvement is the inclusion of a smoke detector which operates the water spray only when the spray is required. (Author abstract modified)

41438 **APTIC NO. 64391**

Speich, P.

COAL GASIFICATION WITH NUCLEAR PROCESS HEAT. *(Kohlevergasung mit nuklearer Prozesswaerme). Text in German. VGB Kraftwerkstechnik, 54(7):438-446, July 1974. 10 refs.*

Coal gasification with nuclear heat produces little carbon dioxide and the emission of sulfur is avoided. Through the use of nuclear heat about 30 to 40% of the coal is saved which in conventional gasification processes would have to be used for producing the required process heat. Various processes of coal gasification are described such as hydrating gasification, a combination of hydrating gasification and water vapor gasification, and gasification of soft coal with its own water as gasifying agent in a tube gasifier. Hydrating gasification of soft coal with nuclear heat causes lower energy losses than if the nuclear power were used for the generation of electricity. With the former practice 53.9% of the energy ultimately reaches the consumer versus 35.1% when nuclear power is used for the generation of electricity.

41439 **APTIC NO. 63874**

Squires, B. J.

FABRIC FILTER PLANTS FOR CLEANING GASES FROM NON-FERROUS METAL FURNACES. *Filtration Separation (Purley), 11(3):277-278, 280, 282, 284, 286, 288, May/June 1974. (Presented at the Filtration Society, Conference on What s New in Dust Control and Air Cleaning, London, England, Sept. 25-27, 1973.)*

Because of their high collection efficiencies, fabric filters are being used increasingly for industrial dust control. Alternative fabric systems are discussed, and actual industrial applications are described by six typical filter installations in the nonferrous metals industry, namely, copper alloy manufacture, scrap battery melting, secondary smelting of aluminum, secondary smelting of copper and brass, primary lead smelting, and primary aluminum smelting. The efficiency of various types of collectors and filters depends on particle size. Fabric filters and fabric filters with pre-coat give 99.8 and greater than 99.9% efficiency on standard dusts and 99.9 and greater than 99.9% efficiency on 10 micron dust, 5 micron dust, and 1 micron dust. Commonly used filter fabrics include cotton, wool, polypropylene, nylon, orlon, terylene, nomex, Teflon, and glass fiber. Types of filters include screen types, tubular fabric filters, and reverse jet tubular filters. (Author abstract modified)

41440 **APTIC NO. 63662**

Srivastava, J. P.

TRANSIENT RESPONSE CHARACTERISTICS OF AN EXHAUST GAS TURBOCHARGER. *J. Automotive Eng., 5(2):13-20, April 1974. 18 refs.*

Exhaust gas turbocharger engines can be used in electrical generating units, maring propulsion, locomotives, and automobiles. They operate on lower grades of fuel and produce less pollution than normal engines. Sluggish response of the turbocharger during sudden loadings can cause deterioration in engine performancy and increased emissions, however. Therefore, experimental and theoretical studies were conducted of the dynamic response characteristics of the turbocharger during rapid variations in operating conditions. The experimental test rig and instrumentation used are described. The test rig was capable of simulating the engine exhaust conditions during the period of rapid load variations. The mass flow rate through the turbine, the pressure and the temperature at the turbine inlet, and the duration of their variation could be controlled within wide limits. The experimental performance of the turbocharger during the transient operation could be recorded with a reasonable degree of accuracy. The theoretical procedure which was developed, assuming that the steady state performance characteristics of the turbocharger compressor and turbine were valid instantaneously during transient operation, was capable of predicting the transient response characteristics of the turbocharger with a fair degree of accuracy. The theoretical accuracy could be improved if a complete set of accurate turbocharger compressor and turbine characteristics were used and if a smaller mesh were used to interpolate the compressor and turbine parameters from these characteristics. (Author conclusions modified)

41441 **APTIC NO. 64394**

Stephens, Ruth E.

METHOD OF DECOMPOSING NITROGEN OXIDES. *(Ethyl Corp., Richmond, Va.) U. S. Pat. 3,787,560. 3p., Jan. 22, 1974. 2 refs. (Appl. Jan. 24, 1972, 6 claims).*

A catalytic method of decomposing nitrogen oxides in a gas stream at elevated temperatures is described. The catalyst consists essentially of neodymium oxide and barium oxide on a suitable support. The catalysts are especially useful in reducing the nitric oxide content of the exhaust gas of internal combustion engines. (Author abstract modified)

41442 **APTIC NO. 64306**

Stettler, Richard James and Albert Jan Verdouw

COMBUSTION APPARATUS. *(General Motors Corp., Detroit, Mich.) Brit. Pat. 1,352,823. 9p., May 15, 1974. (Appl. Jan. 11, 1973, 5 claims).*

A high intensity combustion apparatus is described which employs recirculation of combustion products for reduction of the temperature level and oxygen content in the combustion zone and hence reduction of oxides of nitrogen. The combustion unit is particularly suited for use with gas turbine engines. A duct for dilution air is defined between inner and outer casings of the unit, and a recirculation duct for combustion products is defined by the inner casing and a combustion liner mounted within the inner casing. The combustion air duct has an air inlet means at the upstream end and terminates in an annular jet pump nozzle at the downstream end adapted to discharge the combustion air over the outer wall of the combustion liner into the recirculation duct and to entrain and energize a substantial portion of the combustion products flowing from the downstream end of the liner through the recirculation duct into the upstream end of the liner.

41443 **APTIC NO. 63733**

Tabata, Norikazu, Shigenori Yagi, Seiji Inoue, Sukehisa Noda, and Shigeru Koikawa

BASIC CHARACTERISTICS OF OZONIZERS AND EVALUATION OF MITSUBISHI OZONIZER. *(Mitsubishi Ozonaiza). Text in Japanese. Mitsubishi Denki Giho (Tokyo), 48(4):724-730, April 1974. 7 refs.*

An ozonizer is a very effective device to purify water and air. With increased ozonizer efficiency and enlargement of scale, the ozonizer has become increasingly important for odor removal. The basic concepts of discharge physics in the ozonizer are discussed. Fundamental data regarding ozone generating efficiency is given together with considerations of the construction and characteristics of commercial ozonizers.

41444 **APTIC NO. 64418**

Takaura, Yoshizo

ON A DUST PRECIPITATOR USED IN A CUPOLA. *(Kyupora yo shujin sochi ni tsuite). Text in Japanese. Nenryo oyobi Nensho (Fuel And Combustion), 41(7):653-657, July 1974.*

Equipment capable of 90% desulfurizing efficiency is described. Composition of dust from the cupola are metal oxides of 2-5 micron, ashes of coke of 20 to 50 micron and adsorbing sand, rust, powder of limestone and fire-proof materials of 100 to 500 micron. A dry-cap or wet-cap dust precipitator are available in the cupola. The former is capable of collecting dust of around 300 micron, but is not efficient of less than 80 micron. The latter is capable of collecting dust of 150 to 200 micron, but not 60 micron. To obtain the highest efficiency of a dust precipitator, the dust volume must be at most 2-4 and 0.2 g/N cu m at the inlet and outlet of a dust precipitator respectively, and dust size must be less than 60 micron. A preliminary test on aspiration, collecting efficiency, and treatment of dust collected was conducted. The pressure inside the air blower was raised, and the spray pressure was also raised from 2-2.5 to 3.5-5.0 Kg/sq cm so that collecting efficiency could improve. The measurement of the cupola's efficiency extended over 3 mo, during which the operating condition on the equipment was varied. The exhaust dust volume was 0.2449 at its maximum and 0.0644 g/N cu m at its minimum.

41445 **APTIC NO. 64421**

Tayama, Ikutaro

A NEW TECHNIQUE TO ELIMINATE NITROGEN OXIDES CALLED MON. *(Dassho gijutsu MON purosesu). Text in Japanese. Sekiyu Gakkai shi (J. Japan Petroleum Inst.) (Tokyo), 17(6):509-512, June 1974.*

Equipment capable of treating 20,000 N cu m/hr or exhaust gas from an electric furnace for steel manufacturing by absorption is described. The MON process consists of absorption of nitrogen oxides by washing with a weak alkaline solution of potassium permanganate and potassium permanganate and manganese dioxide are recovered. When a large quantity of dust is present in the exhaust gas dust collector is necessary, since the dust accumulates in the packed substance of an absorption tower. Water must be sprayed on high temperature exhaust gases in order to reduce its temperature. Manganese dioxide is separated from the solution by a filter. The MnO2 separated thus is oxidized to potassium manganate using potassium hydroxide and an oxidizing agent. Potassium manganese is then oxidized to potassium permanganate by electrolytic oxidation. The MON process is not affected by sulfur oxides, oxygen, and dust interference when they are included in the exhaust gas. The MON by-product recovery of KMnO4 allows its practical availability and prevents water contamination; there is, however, much labor involved in converting KNO3 to a raw material for fertilizers.

41446 **APTIC NO. 64300**

Titus, Hans-Joachim

IMPROVEMENTS IN FILTRATION APPARATUS. *(Assignee not given.) Brit. Pat. 1,352,629. 6p., May 8, 1974. (Appl. Nov. 4, 1971, 15 claims).*

A filtration apparatus for solids in suspension is described which provides for a washing zone if desired. The device consists of two filter elements in the form of hollow bodies of rotation coaxially mounted one inside the other so that an annular chamber exists between the two filter elements. An inlet and outlet are provided along with a means for withdrawing liquor which passes from the annular chamber to the interior of the inner filter element and to the exterior of the outer filter element. A means also exists for driving at least one of the filter elements in rotation about the common axis of the two filter elements. Washing liquid may be introduced into a space which is within the inner filter element and is in communication with the annular chamber through at least part of a liquid permeable component of the inner filter element.

41447 **APTIC NO. 63729**

Train, Russell E.

IRON AND STEEL MANUFACTURING; POINT SOURCE CATEGORY. *Federal Register, 39(126):24131-24133, June 28, 1974.*

Proposed regulation is set forth concerning the application of effluent limitation guidelines for existing sources to pretreatment standards for incompatible pollutants. The proposal will amend 40 CFR Part 420, Iron and Steel Manufacturing Point Source Category, establishing for each subcategory therein the extent of application of effluent limitations guidelines to existing sources which discharge the products of wet and semiwet control methods to publicly owned treatment works. The regulation applies to users of publicly owned treatment works which fall within the description of the point source category to which the guidelines and standards promulgated simultaneously apply. However, the proposed regulation applies to the introduction of incompatible pollutants which are directed into a publicly owned treatment works, rather than to discharges of pollutants to navigable waters. The general pretreatment standard divides pollutants discharged by users of publicly owned treatment works into two broad categories: compatible and incompatible. Compatible pollutants are generally not subject to pretreatment standards. Incompatible pollutants are subject to pretreatment standards. A separate provision states the application to pretreatment standards of effluent guidelines based upon best practicable control technology currently available.

41448 **APTIC NO. 65830**

Tsunoda, Toshikazu, Hiroyuki Hiroyasu, Shinji Ikura, and Yuzo Yokoyama

SIMULATION FOR COMBUSTION AND EMISSION OF DIESEL ENGINE (1ST REPORT, IGNITION LAG AND HEAT GENERATION IN CONSTANT-VOLUME COMBUSTION DEVICE). *Text in Japanese. Preprint, Japan Society of Mechanical Engineers, Tokyo, p. 59-62, 1974. 14 refs. (Presented at the Japan Society of Mechanical Engineers, National Meeting, Osaka, Japan, Nov. 3-5, 1974, Paper 1411.)*

A simulation model for a diesel engine combustion and emission gas was based on the behavior of single particles of jet sprayed fuel. Taking the diffusion of mist into consideration, the local ratio, local temperature, and the formation process of combustion products (mainly nitric oxide) at the time of spray combustion were studied. The spark delay and heat formation in a given volume combustor were also studied. The combustion model consisted of atomization, evaporation, ignition, and heat formation theories and mathematical calculations. The spark delay by calculation was compared to that of actual experiments. The results agreed remarkably well even when the atmospheric pressure and temperature were varied. By a high speed camera observation, it was found that ignition did not necessarily occur at the tip of the jet spray as hypothesized but actually occurred in the middle. But the probability of ignition at the tip is greater even in actual situations and all this will not affect the mechanism of spark delay. The model is usable for the calculation of diesel engine combustion and exhaust simulation.

41449 **APTIC NO. 63894**

Utagawa, Mitsuru, Yasuo Iida, Koichi Inoue, and Toshio Odaira

AUTOMOTIVE EXHAUST GAS ATTENUATION DEVICES OTHER THAN CATALYTIC CONTROL AND SPARK TIMING DELAY SYSTEMS. *(Shokubai sochi, tenka jiki seigyo sochi igai no haiki gasu gensho* *sochi ni tsuite). Text in Japanese. In: Studies on Tokyo Smog. Tokyo Metropolitan Research Inst. for Environmental Protection (Japan), Rept. 3, p. 151-157, March 1974. 2 refs.*

Seventeen types of exhaust gas attenuation systems were purchased and used for initial performance tests. Three were secondary voltage stabilization type; two were the fuel improvement type; one was vacuum valve spark control methods; four were the combination of supplementary air and spark timing delay; one was the combination of supplementary air and supplementary fuel; one was the combination of blowby gas circulation and spark timing delay; one was the combination of supplementary air and exhaust gas recirculation; one was the combination of supplementary air and water; one was the combination of supplementary air and plug spacer; one was the combination of plug spacer and catalytic converter; and one was the combination of EGR (exhaust gas recirculation) and spark timing control. The tests were conducted on four-mode and 10-mode driving on a chassis dynamometer. Good results were obtained only from the spark timing control method and the combination of catalytic converter and supplementary air. Generally the fuel improvement methods tended to increase the amount of nitrogen oxides and there was no attenuation effect with the initial performance; the secondary voltage stabilization method tended to increase NOx and hydrocarbons, but one device deserved a further study; the combination of supplementary air and spark timing delay showed a good initial result and the engine conditions remained good, but further endurance and safety tests are required; the combination of supplenentary air and supplementary fuel, water addition, exhaust gas partial recirculation, and partial blowby gas circulation were all ineffective as exhaust attenuation methods. The use of supplementary fuel increased all pollutants. The plug spacer was as effective as spark timing delay. The combination of catalyst and plug spacer was effective but requires further tests for durability and safety.

41450 **APTIC NO. 65938**

Van Gordon, Don

POLLUTION CONTROL AT LOWER COST. *Glass Ind., 55(2):6-7, 14, Feb. 1974.*

A method of recovering the tin tetrachloride from the hot end coating of glass bottles is described. The method prevents the overspray from going out the stack as a visible plume, polluting the atmosphere, and corroding the plant and surrounding facilities. A venturi scrubber, with a pressure drop of 55 in. of water or more across the venturi and an alkaline spray into the venturi throat, will successfully capture the micron and submicron size particles. As the fumes and liquid accelerate into the throat of the venturi, the scrubbing liquid is rapidly broken into micron size droplets. As the gas stream containing the particulates flows into the throat area of the venturi, liquid droplets agglomerate with the particles in tin compounds, permitting the reaction that converts the alkali and tin tetrachloride in tin hydrate and sodium chloride. The construction of the venturi and collecting chamber is fiberglass reinforced plastic. A 55 hp, 4 shop scrubber recovery unit will cost about $4000 per shop and 95% of the tin tetrachloride values will be recovered at a value of 50% of the Sn price for the Sn contained.

41451 **APTIC NO. 66042**

Varde, K. S.

AN OPTICAL INVESTIGATION OF THE COMBUSTION OF A STRATIFIED MIXTURE IN A DUAL CHAMBER CONFINEMENT. *Can. J. Chem. Eng., 52(3):426-431, June 1974. 20 refs.*

Combustion with stratified fuel-air mixtures is discussed. These mixtures cause an increase in the thermal efficiency of the combustion engine. The amount of pollutants formed and emitted in the exhaust gases are reduced. Considerable reduction in the concentrations of carbon monoxide, nitric oxide, and unburned hydrocarbons emitted in the exhaust are reported. The combustion process may be used in internal combustion engines to meet future pollution standards. An analysis of the pattern of the flame propagation in a stratified mixture contained in a dual chamber geometry is presented.

41452 **APTIC NO. 65833**

Viehrig, J.

TECHNOLOGICAL ASPECTS OF THE INCINERATION OF CONCENTRATED POLLUTANT MIXTURES. *(Verfahrenstechnische Aspekte bei der Verbrennung hochkonzentrierter Schadstoffgemische). Text in German. Technik (Berlin), 29(6):385-388, June 1974. 3 refs.*

Technologial and design aspects of the incineration of concentrated, possibly toxic waste gases with low calorific value in available combustion equipment are presented. This method of incineration is especially suited for the incineration of relatively small volumes of waste gases. To avoid troubles in the normal operation of the combustion equipment, it is necessary that the combustion air for the primary fuel be higher than the air content in the pollutant mixture to be incinerated. The incineration process leads to an increased flue gas volume, and possibly to a shift in the dew point. Adequate exhaust conditions for the waste gas to be incinerated may permit the concentration to be increased and the waste gas volume to be reduced, which, however, may result in the formation of explosive mixtures. Regardless of the calorific value of the waste gas, complete incineration is determined by the flame propagation velocity which is a function of the chemical composition, temperature, rate of diffusion, the gas-air ratio, and the flow conditions.

41453 **APTIC NO. 64320**

Wacks, K.

REMOVAL OF MERCURY FROM GASES AND LIQUIDS WITH RESPECT TO ENVIRONMENTAL PROTECTION. *(Quecksilber-Entfernung aus Gasen und Fluessigkeiten in bezug auf den Umweltschutz). Text in German. Fette Seifen Anstrichm., 76(5):229-230, May 1974. 7 refs.*

Methods and adsorbents for the removal of mercury from gases and liquids are described. Filters developed by Mosanto have mercury retention efficiencies amounting to 99.99% for gases, while the removal of mercury vapors is problematic. Iodized and sulfrated activated carbons bind mercury vapors in the form of mercury iodide and sulfide, respectively. The use of the sulfurated activated carbon method is unsuitable for the purification of electrolytically-generated hydrogen due to the formation of hydrogen sulfide. Adsorbents treated with thiosulfate solution retain mercury in the form of mercury sulfide. Silica gel with an apparent pore diameter of 60 A and containing 0.5-5 wt% zinc sulfide proved to be highly efficient in the retention of mercury vapors.

41454 **APTIC NO. 63771**

Wanie, W.

SEPARATION OF FINE DUST FRACTIONS. *(Die Staubabschedung feiner Kernfraktionen). Text in German. Glas-Email-Keramo-Tech., 25(3):45-48, March 1974.*

Problems of and techniques currently used for fine dust separation in the enamel, glass, ceramic, stone, and earth industries are surveyed. Tissue filters are predominantly used for dust separation in these industries, and their efficiency and scope of use have been essentially increased by the introduction of synthetic fiber and needle-punched felt filters that can be used for temperatures up to 250 C. These provide efficiencies of a residual dust concentration of less than 10 mg/cu m. Metal fiber filters were experimentally used for the separation of fine dust from gases with temperatures of up to 800-1000 C. Dust removal from needle-punched felt filters is best by pressure shocks.

41455 **APTIC NO. 65919**

Whittemore, Raymond C.

AN EVALUATION OF THE ADSORPTIVE PROPERTIES OF FLY ASH WITH REFERENCE TO A PULP AND PAPER MILL WASTE EFFLUENT. *Bureau of Mines Information Circ., no. 8640:296-317, 1974. 50 refs. (Presented at the International Ash Utilization Symposium, 3rd, Pittsburgh, Pa., March 13-14, 1973.)*

Fly ashes primarily from boilers burning waste wood and bark with auxiliary fuels such as oil and gas were tested for adsorptive properties. One fly ash from a coal-burning boiler and three from coal- and bark-fired boilers were also tested. The adsorptive properties were defined in terms of the adsorption of iodine, phenol, and color to determine the effectiveness of fly ash in treating pulp and paper mill waste. The fly ashes in general did not have conventional adsorptive properties comparable to a commercial-grade activated carbon. Softwood-bark-derived fly ash did, however, adsorb iodine and phenol better than hardwood-bark-derived fly ashes. The ability of fly ash to be used effectively in the treatment of a particular pulp and paper mill waste was proportional to its lime content. Those fly ashes whose origin was hardwood bark had high color, chemical oxygen compound demand (COD), and 5-day biological oxygen demand (BOD5). Effective treatment was arbitrarily defined as a color reduction of 90% or greater. The fly ash containing high lime had a definite potential for treatment of highly colored industrial wastes such as pulp and paper mill effluents; the treatment was not true adsorption, however, but a chemical precipitation of color-producing and other organic substances within the waste. Sources of fly ash are reviewed. (Author conclusions modified)

41456 **APTIC NO. 65905**

Wilson, Francis C.

A PRACTICAL APPROACH TO PRODUCING PUMPABLE CONCRETE. *Bureau of Mines Information Circ., no. 8640:94-105, 1974. 20 refs. (Presented at the International Ash Utilization Symposium, 3rd, Pittsburgh, Pa., March 13-14, 1973.)*

The design of good concrete for pumping using various aggregates is discussed. The three most important factors in pump concrete involve gradation: gradation of the coarse aggregate, gradation in the sand sizes, and gradation in the fine fines area -- including cement and other finely divided solids such as fly ash. Sand gradation usually appears most critical and/or is most subject to improvement. The coarse aggregates, sand size aggregates, fine fines gradation, and water and slump in the concrete are discussed. The testing of concrete placed by pumping is described. The use of additives as pumping aids has been promoted.

41457 **APTIC NO. 64163**

Wilson, Joseph George

PROCESS AND APPARATUS FOR REMOVING SULPHUR DIOXIDE FROM GAS. *(Shell Internationale Research Maatschappij N. V., The Hague (Netherlands)) Brit. Pat. 1,344,934. 4p., Jan. 23, 1974. (Appl. April 19, 1971, 14 claims).*

A process and apparatus for removing sulfur dioxide from a gas are described which are particularly suitable for treating Claus plant tail gases. A solid acceptor for SO2 is held in separate segments of a rotating element each of which segments is separated from adjacent segments by gas impervious walls and is carried by each complete rotation of the element sequentially first through an acceptance zone where the acceptor contacts a flowing stream of SO2 containing gas, then through a regeneration zone where the acceptor contacts a flowing stream of a regenerating gas and finally through a purging zone where the acceptor contacts a flowing stream of a purging gas. This process is an improvement over currently employed process primarily because the process may be employed with a high temperature flue gas without reducing the temperature of the flue gas, and thereby its buoyancy for passing up a stack. Additionally, a relatively thin and easily penetrated bed of solid acceptor may be used, particularly if shaped solid acceptors are employed that have straight, elongated passageways that are oriented in the direction of flow, so that there is very small pressure drop consuming in passing the SO2 containing gas through the bed.

41458 **APTIC NO. 63745**

Yeh, Hsu-Chi and Benjamin Y. H. Liu

AEROSOL FILTRATION BY FIBROUS FILTERS--I. THEORETICAL. *J. Aerosol Sci., 5(2):191-204, March 1974. 21 refs.*

Current theory of aerosol filtration by fibrous filters is based on the Kuwabara-Happel flow field for the cell model. Previous studies in this area have involved mostly an examination of three main filtration mechanisms: Brownian diffusion, direct interception, and inertial impaction, either separately or by combining direct interception with Brownian diffusion or inertial impaction. The results of an investigation of these three mechanisms used simultaneously, and the development of a computational procedure to predict efficiencies of a fibrous filter for both the continuum and the slip-flow regimes, are presented. The theoretical procedure involved the development of a modified Kuwabara-Happel flow field allowing for slip effects, the development of an effective fiber length factor to assess filter nonuniformity, and the calculation of single fiber efficiency by using equations of motion of the particles either to solve the convective-diffusion equation or to integrate them for solving the particle trajectory. The solutions for both cases were performed on a digital computer. (Author abstract)

41459 **APTIC NO. 63746**

Yeh, Hsu-Chi and Benjamin Y. H. Liu

AEROSOL FILTRATION BY FIBROUS FILTERS--II. EXPERIMENTAL. *J. Aerosol Sci., 5(2):205-217, March 1974. 14 refs.*

A previously described theory of aerosol filtration by fibrous filters was verified using filters of uniform sized fibers and monodisperse aerosols of D1-2-ethylhexyl phthalate (DOP). The filters consisted of dacron fibers of 11.3 micron diameter, and the DOP particles ranged in size from 0.37 to 1.07 micron. Filter fiber volume fraction varied between 0.013 and 0.085, and the filtration pressure varied from 0.2 to 1 atm. The experimental results, together with similar results reported by other investigators, were compared with the theoretically predicted values. Good agreement was found. (Author abstract)

41460 **APTIC NO. 65768**

Yukitake, Tsugita and Norio Nerihaya

DESULFURIZATION SYSTEM. *(Detsuryu sochi). Text in Japanese. (Hitachi Co., Tokyo (Japan)) Japan. Pat. Sho 49-24591. 2p., July 2, 1974. (Appl. Dec. 25, 1970, 1 claim).*

A desulfurization system with a scraping device for solid caustic soda caked along the wall of the absorption tower is described. Flue gas containing sulfur dioxide enters the absorption tower and mingles with atomized caustic soda sprayed from the nozzles at the top of the tower. The SO2 is absorbed and forms sodium sulfate mist; most of it is dried by the heat of the flue gas and is collected by a cyclone dust collector. But part of it adheres on the inside wall of the absorption tower, forming, eventually, a thick layer of soda cake. This invention has a multiple number of steel chain belts hanging from the top of the tower along the inside wall, and a hammering mechanism operated by motor (automatic and frequency adjustable) shakes the chains which scrape the cake formation.

41461 **APTIC NO. 64321**

Zermizoglou, R.

CATALYTIC PURIFICATION OF EXHAUST GASES. (L epuration catalytique des gaz d echappement). Text in French. Bull. Inform. Sci. Commis. Energ. At. (Fr.), no. 191:81-89, April 1974. 6 refs.

A state-of-the-art report is presented on the development of automotive exhaust catalyst materials and catalytic afterburners by the three leading American automobile manufacturers and by Peugeot-Renault. The 1975 American cars will be equipped with catalytic afterburners using platinum and palladium catalysts deposited on particulate or monolithic refractory supports. The afterburners will have a volume of 1-5 l, and contain 1 to 5 g palladium and platinum. Their price is expected to range from $250 to $300. The gasoline-lead content will be reduced to 0.013 g/l to minimize catalyst poisoning hazards. While rruthenium is the best catalyst for the reduction of nitrogen oxides at negligible rate of ammonia formation, it has the disadvantage that its oxide is volatile and thus causes catalyst losses.

41462 **APTIC NO. 63441**

PREVENTION OF AIR POLLUTION GENERATED BY THE COMBUSTION OF HYDROCARBONS. *(Prevention de la pollution de l air par les produits de combustion des hydrocarbures). Text in French. Tech. Moderne, 66(4):28-29, April 1974.*

Possibilities of the abatement of pollutant emissions associated with the combustion of hydrocarbons in power plants, domestic heating equipment, and vehicles are surveyed. Sulfur dioxide emissions can be abated by fuel desulfurization of flue gas desulfurization, the latter especially by treating the flue gases with ammoniacal solution which, after retaining SO2 and dust, is treated with hydrogen sulfide to obtain liquid sulfur. Fuel desulfurization is possible by direct desulfurization by hydrogenation to a residual sulfur content of 0.5-1%, or by indirect desulfurization in which a distillate is desulfurized by catalytic hydrogenation to 0.2-0.3%, and the high-sulfur residue is either gasified for sulfur removal or fired in special combustion equipment provided with an SO2 emission control device. The pollutant emissions from vehicle engines can be abated by a modification of the combustion chamber design, such as the combustion chamber of variable geometry providing for a more homogeneous mixture. Such combustion chambers reduced the smoke and nitrogen oxides emissions by about 50%. Nitrogen oxides, carbon monoxide, and unburned hydrocarbons can be destroyed by means of catalytic exhaust control devices. Lead-free gasoline with unchanged octane number can be obtained by catalytic reforming or new refining processes. Hydrogen fuel cells as energy sources for automobiles are being studied.

41463 **APTIC NO. 63542**

Environmental Protection Agency, Washington, D. C., Test and Evaluation Branch

EXHAUST EMISSIONS FROM A DIESEL-POWERED NISSAN PASSENGER CAR. *Rept. 74-33AW, 3p., May 1974.*

Exhaust emissions from a diesel-powered Nissan passenger car were evaluated. All tests were run in accordance with the 1975 Federal Test Procedure for light-duty diesel-powered vehicles. The vehicle achieved the 1976 interim emission levels at both low mileage and at 4000 mi. Significant reductions in emissions occurred after 4000 mi were accumulated on the vehicle. Hydrocarbon and carbon monoxide are about 50% of the specified limits and nitrogen oxides are about 75% of the 1976 interim level.

41464 **APTIC NO. 63571**

Environmental Protection Agency, Washington, D. C., Test and Evaluation Branch

EVALUATION OF A FILTRON URETHANE FOAM AIR FILTER ELEMENT. *Rept. 74-23 AWK, 3p., Feb. 1974.*

The evaluation of the Filtron urethane foam air filter element designed as a replacement for an OEM paper filter element is described. Four tests were conducted on a 1971 Ford Galaxie 500, 351 CID. There was not a significant reduction in exhaust emissions. The percent of change from baseline with the Filtron filter was a 5% decrease in hydrocarbons, 2% decrease in carbon monoxide, no change in carbon dioxide, 5% increase in nitrogen oxides, and 1% improvement in fuel economy.

41465 **APTIC NO. 63572**

Environmental Protection Agency, Washington, D. C., Test and Evaluation Branch

EVALUATION OF THE VAREB 10 GASOLINE-WATER EMULSION. *Rept. 74-30 AW, 4p., April 1974.*

The evaluation of the Vareb 10 gasoline-water emulsion for automobile emissions control is described. All tests were run as directed in the 1975 Federal Test Procedure. A 1970 Chevrolet was run with a baseline idle carbon monoxide of 0.1% and when the baseline idle CO was set at 6.0% to counter the lean air/fuel ratio that occurs when using the Vareb 10. The car suffered such severe driveability problems apparently due to the leaning of the air/fuel mixture that no meaningful emissions data could be generated. A 1963 Chevrolet was run with a baseline idel CO of 0.8%; after being prepped on the Vareb 10, the idle CO was set to 2.2%. There were no major driveability problems. The fuel produced a 39% hydrocarbon reduction, a 55% CO reduction, a 24% nitrogen oxides reduction, and a 10% fuel reduction.

41466 **APTIC NO. 63573**

Environmental Protection Agency, Washington, D. C., Office of Air and Waste Management

EVALUATION OF TWO PROTOTYPE SUZUKI FRONTE VEHICLES. *Rept. 74-32 DWP, 4p., May 1974.*

An evaluation of two low emission prototype Suzuki Fronte vehicles is described. The emission control systems incorporated several novel features: a fuel distillation system for cold starting and a thermal reactor in combination with an air pump and timed exhaust system spark ignition for combustion of the hydrocarbon rich exhaust found typically in two stroke applications. The 1976 statutory emissions levels were achieved consistently. All EPA testing was conducted at 680 kg and Suzuki tested the vehicles at 680 kg. Their typical 75 Federal Test Procedure are 0.12 g/km (0.20 g/mi) hydrocarbons, 1.20 g/km (1.93 g/mi) carbon monoxide, 0.14 g/km (0.23 g/mi) nitrogen oxides, and 10.9 l/100 km (21.5 MPG).

41467 **APTIC NO. 63691**

A REPORT ON THE CONTROL OF ENVIRONMENTAL POLLUTION AT TSC S FACTORIES. *Taiwan Sugar, 21(2):42-43, 45-48, 50-51, April 1974.*

The sugar mills at TSC s factories burn bagasse as fuel for the boilers; this produces fly ash or black smoke. Pollution control is accomplished by cyclone dust collectors and water spraying. Disposal of the wash water without causing water pollution is being studied. One by-product factory, the Kaohsiung Particle Board Factory, uses surplus bagasse pith as a boiler fuel which causes air pollution. Several dust collectors were added and improved to collect the bagasse pith particles and store them for use as fuel. Presently, the black smoke the Kaoshiung Particle Board Factory meets the international Ringelmann No. 2 standard. Water spray scrubbers were also installed at the Kaoshiung District sugar factory mills. The various control methods and their costs are discussed. Control of water pollution is also mentioned.

41468 **APTIC NO. 63701**

TECHNIQUE FOR ENVIRONMENTAL PROTECTION IN THE USA. *(Technik fuer den Umweltschutz. Ein Blick auf USA). Text in German. Umwelthygiene, 25(4):85-86, April 1974.*

The state of the art of air pollution control measures taken or being planned in the USA is presented. The planned limitation of the nitrogen oxides emission from 1976 cars to 0.4 g/mi has been suspended for 1 yr. The interim emission standard of 2 g/mi can be satisfied by the exhaust gas recirculation system that is also supposed to improve the gas mileage. The use of high-sulfur fuel oil in periods of temporary short supply has been proposed. Federal standards have been imposed on sulfur oxides, particulate matter, carbon monoxide, photochemical oxidants, hydrocarbons, and nitrogen oxides. Similar standards will be imposed on more air pollutants.

41469 **APTIC NO. 63723**

Electric Power Source, Ltd.

ELECTRIC POWER COMPANIES AND ENVIRONMENTAL PROTECTION--THE PRESENT STATE AND COUNTERMEASURES. *(Kankyo hozen ni torikumu denryoku kakusha--genjo to taisaku). Text in Japanese. Denki Kyokai Zasshi (J. Japan Elec. Assoc.), no. 606:6-17, April 1974.*

The Electric Power Source, Ltd., with 45 hydraulic power plants and four thermal power plants, organized a special environmental site selection department, and the environmental status of all power plants and power cables was checked during 1973. In the case of hydraulic power plants, the preservation of the natural environment is the focal point. The restoration of the natural environment at areas altered during dam construction was planned and carried out after careful topographical, geological, meteorological, and biological studies. For the thermal power plant, various air pollution control measures were taken. Sulfur oxides emission control by means of low-sulfur content fuel and increased chimney height leaves very little room for further improvement. The first wet-type desulfurization system was installed in July 1973, and the second installation was scheduled for August 1974. For dust control, the high efficiency electric dust collector is used. Nitrogen oxides emission is controlled mainly by two-stage combustion with 30-20% reduction efficiency. The gas recirculation method is under consideration. The noise problem is dealt with by placing the noisy machinery inside and by providing soundproof insulations for every possible area. Waste water containing acids, alkalis, and oils are treated by the appropriate methods before disposal.

41470 **APTIC NO. 63765**

SULZER COMPANY AND ENVIRONMENTAL PROTECTION. *(Sulzer und Umweltschutz). Text in German. Schweiz. Tech. Z., no. 13: 252-256, March 28, 1974.*

Measures taken at Sulzer Company in environmental protection area are described. Smokes with a high magnesia content from the spherical graphite iron foundry and brown smoke from an electric- arc furnace are purified by means of bag filters made of textile material for dust removal. The residual concentration is less than 20 mg/cu m. Dust generated in machine shops in which castings are processed is removed by central or individual exhaust and dust separation systems, and the purified air is returned immediately.

41471 **APTIC NO. 63826**

Osaka Gas Company (Japan)

THE FUMAKS, RHODACS AND COMPACS PROCESSES. *(Fumakkusuho, roddakkusuho, konpakkusuho ni tsuite). Text in Japanese. Aromatikkusu (Aromatics), 26(3):27-30, 1974.*

The fumaks, rhodacs and compacs processes are a series of processes for complete treatment of toxic hydrogen sulfide and hydrogen cyanide. In the fumaks desulfurization process, H_2S is removed by the absorption in an aqueous alkali solution containing picric acid type catalyst. Using ammonia and picric acid, a redox-system is established in the reaction system, and H_2S is continuously oxidized to sulfur. In the rhodacs process, the toxic HCN is removed as thiocyanate by washing the exhaust gas with aqueous alkali sulfur suspension. The reaction mechanism in the case of using NH_4OH as an alkali is described. In the compacs process, the colloidal sulfur produced in the fumaks process and thiocyanate and thiosulfate produced in the rhodacs process are separated by the cracking combustion of aqueous solutions. The dissolved components are converted to carbon dioxide, nitrogen, water, and sulfur dioxide leading to a sulfuric acid production plant or to an emission gas desulfurization system, and recovered as sulfuric acid or gypsum. The actual processes are described in detail with flow diagrams, and operational conditions and results are also given. By a series of these processes, the most toxic gaseous components can be removed efficiently and economically, and recovered as H_2SO_4 and gypsum without the problem of secondary pollution.

41472 **APTIC NO. 63972**

MODIFICATION WORK TO TOKYO ELECTRIC POWER CO., INC. S ANEGASAKI NO. *4 BOILER FOR ADDITION OF AN LNG FIRING SYSTEM. (Tokyo denryoku kabushiki gaisha anezaki karyoky hatsudensho dai4-go boira 600,000 kw yunittoyo boira ni okeru LNG kintsuika kaizo no keiken). Text in Japanese. Ishikawajima Harima Giho (Ishikawajima Harima Eng. Rev.), 14(3):323-329, May 1974. 1 ref.*

Modification of a once-through steam generator for use with a 600,000 kw electric generating unit is described for addition of a liquefied natural gas firing system. Coordination of the LNG- firng system with the existing oil-firing system involves the addition of gas burners, pipings, valves, a burner control system, and a gas-firing control system. Multi-spud type gas burners are equipped to all burners in addition to the existing oil-firing burners. The fuel firing rate is controlled by the ratio of the number of fuel burners operating to that of the total number of burners. An operational record of the unit is also presented.

41473 **APTIC NO. 64080**

Environmental Protection Agency, Research Triangle Park, N. C., Test and Evaluation Branch

PRELIMINARY REPORT ON EPA EXHAUST EMISSIONS TESTS ON THE CARTER STEAM CAR. *Preprint, 11p., May 1974.*

A steam-powered car was tested for exhaust pollutant mass emissions and other parameters and power characteristics. The results, although encouraging, indicated that the nitrogen oxide emissions were too high to meet 1977 statutory limits. As a result of these findings, the car was improved and again tested. The new tests gave emission levels below those required by the 1977 Federal standards. Composite test results on two days were .344 and .399 gpm hydrocarbons, 1.33 and 1.08 gpm carbon monoxide, .39 and .33 gpm nitrogen oxides, and 12.7 and 14.9 mi/gal fuel economy.

41474 **APTIC NO. 64099**

Environmental Protection Agency, Research Triangle Park, N. C., Test and Evaluation Branch

A COMPARATIVE STUDY OF THE FUEL ECONOMY CHARACTERISTICS OF MAZDA ROTARY ENGINE VEHICLES VERSUS CONVENTIONAL RECIPROCATING ENGINE VEHICLES. *Rept. 74-27, 21p., 1974. 2 refs.*

When the Environmental Protection Agency published fuel economy data showing relatively low fuel economy for Mazda rotary engine vehicles, Mazda challenged these findings. Therefore, another study was made to investigate whether the relationship of fuel economy in city driving to highway driving may be different from that relationship for conventionally-powered cars, which might account for differences in fuel economy results reported by Mazda and by EPA. The test program consisted of development of a highway driving cycle to simulate on the dynamometer the manner in which vehicles are driven outside of cities; of the determination of the comparative fuel economy of Mazda and contemporary piston engine vehicles on the newly developed highway driving cycle and the Federal City Driving Cycle; of identifying inherent differences between the rotary and piston engine that could further explain the fuel economy differences based on the hot start versus cold start fuel economy characteristics of the two engine types; and of comparing conventional engines with Mazda engines for fuel economy. The relationship of fuel economy results obtained by comparing highway driving to cold start vehicle operation on the Federal City Driving Cycle was about the same for the Mazda as for conventional piston engine vehicles; i.e., highway driving resulted in about 50% better fuel economy. On both the highway and city cycles, the Mazdas and the heavier Ford Torino demonstrated similar fuel economy that was lower than that of other vehicles that were in the same weight class as the Mazda. No significant differences between relative hot start and cold start fuel economy were found. Tuneup state was important in testing for fuel economy.

41475 **APTIC NO. 64136**

(Inventor not given.)

AIR POLLUTION CONTROL SYSTEM AND METHOD. *(Combustion Engineering, Inc., Windsor, Conn.) Brit. Pat. 1,349,461. 4p., April 3, 1974. (Appl. Aug. 23, 1971, 6 claims).*

A method for removal of sulfur oxides from flue gases is described which permits greater reaction with sulfur dioxide and avoids scaling problems associated with dry limestone and wet scrubbing processes. The flue gas is contacted with an aqueous scrubbing stream containing an alkaline earth metal bicarbonate such that the SO2 component of the SOx reacts with the bicarbonate to produce alkaline earth metal bisulfite in solution. The amount of alkaline earth metal bicarbonate in the scrubbing stream is maintained in excess of the amount needed to react completely with the SOx, and the pH of the scrubbing stream is maintained between 6.0 and 4.5. The scrubbing stream containing the bisulfite in solution is contacted with a free oxygen- containing gas stream whereby the bisulfite is oxidized to form alkaline earth metal sulfate precipitate and sulfuric acid in solution. Alkaline earth metal carbonate is introduced into the scrubbing stream in an amount such that the carbonate reacts with the H2SO4 to form additional alkaline earth metal sulfate precipitate and form alkaline earth metal bicarbonate in solution. The alkaline earth metal sulfate precipitate is separated from the aqueous scrubbing stream, and the scrubbing stream containing the alkaline earth metal bicarbonate is recycled into contact with the flue gas.

41476 **APTIC NO. 64299**

(Inventor not given.)

GAS PURIFICATION TOWER. *(Heinrich Koppers Gasellschaft Mit Beschrankter Haftung, Essen (West Germany)) Brit. Pat. 1,343,007. 7p., Jan. 9, 1974. (Appl. June 30, 1972, 5 claims).*

A gas purification tower for the dry purification of gases by chemical reaction is described which reduces or obviates disadvantages of prior art devices of similar nature concerning clogging and reduction of the cross sectional area of the gas purification substance. The tower consists of superposed packing baskets, a gas inlet and outlet, a central tube passing through the packing baskets, and an annular space for the passage of gas between the baskets and the tower casing. Each basket has a bottom grate and a trapezoidal cross section widening out in the upward direction. Part of the grate of each basket, which is provided with gas passage apertures, is hinged and capable of being pivoted upwards through 90 degrees. The side walls of the baskets are internally smooth, and the central tube in the zone of the baskets is constituted by the inner side walls thereof. A gas collecting chamber situated between the grate and a bottom plate of each basket communicates with the central tube via apertures. The supporting strips are disposed on the outside of the baskets. A gas supply conduit connects the annular space between the baskets and the tower casing with the gas inlet. A gas discharge conduit connects the central tube to the gas outlet.

41477 **APTIC NO. 64301**

(Inventor not given.)

BAG SHAPED FILTER. *(American Air Filter Co., Inc., Louisville, Ky.) Brit. Pat. 1,352,548. 3p., May 8, 1974. (Appl. June 10, 1971, 11 claims).*

A pocket type filter for separating contaminant particles from a gaseous stream is described which overcomes gas flow resistance, reduced efficiency, and high cost associated with similar prior art pocket filters. The self sustaining bag shaped filter is made of flexible expansible and compressible filter medium, with the bag having longitudinal seams formed by compressing the medium at spaced parallel intervals so as to provide between the seams columns of medium extending from the open end to the closed end of the bag. The filter medium may be fiberglass.

41478 **APTIC NO. 64303**

(Inventor not given.)

APPARATUS FOR SUPPLYING AIR FOR AFTERBURNING OF AN INTERNAL COMBUSTION ENGINE. *(Robert Bosch GmbH, Stuttgart (West Germany)) Brit. Pat. 1,352,966. 3p., May 15, 1974. (Appl. May 2, 1972, 2 claims).*

An apparatus for supplying air from afterburning exhaust gases of an internal combustion engine for motor vehicles is described which overcomes prior art disadvantages of excessive size, power consumption, and complexity. The device consists of an air pump; a drive-pully; a magnetic clutch which, when energized, provides a direct connection between the pulley and the air pump; and means for applying an energizing voltage to energize the magnetic clutch over a range of engine speeds from a first, idling speed up to a second speed corresponding to a maximum speed for the air pump. Means are also provided for removing the energizing voltage to deenergize thy clutch when the second speed is exceeded.

41479 **APTIC NO. 64308**

Inventor not given.)

IMPROVEMENTS IN OR RELATING TO THE PROCESSING OF COKE OVEN GAS. *(Firma Carl Still, Postfach (Germany)) Brit. Pat. 1,352,759. 4p., May 8, 1974. (Appl. Nov. 26, 1971, 10 claims).*

A method for removing hydrogen sulfide and ammonia from coke oven gas is described which allows for a higher proportion of H2S removal without the consumption of steam being increased correspondingly. The coke oven gas is passed through an H2S wash tower having a first input for ammoniacal wash liquid and an output for used wash liquid, followed by passage through an NH3 wash tower in which ammonia is removed with water. The wash liquid is circulated from the H2S wash tower to a deacidifier for regeneration of the wash liquid. A part of the regenerated wash liquid is returned through a cooler to the H2S wash tower, while a second part is returned to the H2S wash tower through a separate input at a temperature above that at which the first part enters. The ammonia is removed from excess wash liquid from the deacidifier to form ammoniacal vapors which are fed wholly or partly to the deacidifier and waste water.

41480 **APTIC NO. 65897**

Economic Commission for Europe, Geneva (Switzerland)

ACTIVITIES OF THE ECONOMIC COMMISSION FOR EUROPE IN THE FIELD OF ASH UTILIZATION. *Bureau of Mines Information Circ., no. 8640: 19-25, 1974. (Presented at the International Ash Utilization Symposium, 3rd, Pittsburgh, Pa., March 13-14, 1973.)*

The United Nations Economic Commission for Europe is conducting a number of research programs to solve energy and environmental problems. I s research in the field of utilization of fly ash produced by coal-fired thermal power stations is discussed. Ash can be used in the production of concrete, prefabricated construction elements, pipes, and elevated fumes. The present situation of fly ash utilization is reviewed. In Economic Commission for Europe countries in 1971, about 23.9% of the fly ash was used for road construction, compacted concrete, filler on construction sites, and other uses. The production and utilization of ash from hard coal in the different countries are listed according to use. Future research which is needed in this field is discussed.

1973

41481 **APTIC NO. 64219**

Acres, Gary J. K.

CATALYSTS FOR REDUCING CONTAMINATION BY EXHAUST GASES. *(Katalysator). Text in German. (Johnson, Matthey and Co., Ltd., London (England)) W. Ger. Pat. Appl. 2,231,296. 45p., April 19, 1973. (21 claims).*

The catalyst comprises an inert ceramic base of honeycomb form whic is coated with 1 or several layers of 10-70% zeolite or molecular sieve types of ceramic from which the sodium was ionically exchanged for scandium, yttrium or a lanthanide and bonded with active alumina and a final layer of rhodium-platinum alloy with Rh 1-50 and a base metal 0.01-25%. Thus, catalysts with an intermediate layer containing 10-50% of the ion exchanged zeolite and the remainder Al_2O_3 and with 7 1/2% Rh-Pt alloy as the outer layer are compared with a catalyst A containing the same outer laye but on 100% Al_2O_3 by passing through an artificial exhaust gas. Total transformation occurs at an entering temperature of 270 C when the intermediate layer contains 10% zeolite whereas the entering temperature must be 315 C for total transformation with A.

41482 **APTIC NO. 64005**

Ando, Jumpei and Shoichiro Hori

SULPHUR DIOXIDE REMOVAL FROM WASTE GASES: A STATUS REPORT JAPAN. *Society of Engineering Science, Pollut. Eng. Sci. Solutions, Proc. Int. Meet. Soc. Eng. Sci., 1st, Tel Aviv, Israel, 1972, p. 235-252, 1973. 12 refs. (June 12-17.)*

Desulfurization of waste gases is growing in importance in Japan parallel to the mounting use of heavy fuel oil containing 2.5% sulfur on the average. Many processes for sulfur dioxide removal have been developed and used recently on a commercial scale. The increasing dependence on energy from petroleum and the lack of low-sulfur fuel oil are described. Since even hydrodesulfurization cannot meet the demand for low-sulfur fuel oil, stack gas desulfurization must be used in many cases to meet SO_2 emission standards. The history of waste gas desulfurization in Japan is discussed including ammonia scrubbing, the zinc oxide process, the lime-gypsum process and the rotary atomizer, catalytic oxidation, regeneration dry processes using charcoal or copper oxide, reduction using sodium carbonate, direct-recovery process, the lime-gypsum process, the dilute sulfuric acid process, the ammonia process, the manganese oxide process, the activated carbon process, and other processes. Desulfurization cost is about $7.58/kl oil to treat flue gas from a 100 MW power plant and $.55/kl oil for a 350 MW plant. Wet flue gas desulfurization, dry flue gas desulfurization, and topped-crude hydrodesulfurization give, 90, 80, and 70% sulfur removal, respectively. Many of the methods for removing SO_2 produce by-products which can be used in various processes. The estimated supply and demand for sulfur and its compounds are reviewed. A considerable oversupply of sulfur and its compounds may occur. Gypsum seems to be the most promising by-product.

41483 **APTIC NO. 64215**

Arendt, Horst

REDUCTION OF THE TOXICITY OF AUTOMOTIVE EXHAUST GASES. *(Verfahren zur Verminderung von Schadstoffemissionen bei Reaktionsaggregaten fuer gasfoermig und feste, gasfoermig und fluessige oder gasfoerige Reaktionsgemische durch Beschichtung mit Edelmetallen oder Legierungen aus Metallen der achten Gruppe des Periodensystems). Text in German. (Arendt geb. Schoen, Gundala, Wilnsdorf (Germany) W. Ger. Pat. Appl. 2,157,030. 10p., May 24, 1973. (6 claims).*

The carbon monoxide, nitrogen dioxide, and hydrocarbon portions in automotive exhaust gases were reduced by coating exhaust gas reaction chambers and parts of the combustion chamber with catalyst layers containing Group VIII metal alloys and optionally copper, tin, or silver and adding 10-12% excess oxygen to the combustion gases. Thus, inlet and outlet valves of an internal combustion engine were coated with a 80:10:5 palladium-platinum-nickel alloy. The exhaust pipe and the quarter bend were partially coated with Ag and with a 80:10 Sn-Ni alloy and the residual part of the exhaust pipe with a 80:10:5 Pd-Cu-Ni alloy. The catalytic activity was constant up to 40,000 km and the exhaust gas contained less than 1 g CO, less than 0.5 g hydrocarbons, and less than 1 ppm NO_2 per 100 kg fuel.

41484 **APTIC NO. 65809**

Atkins, Richard S.

PROCESS EXPERIENCE OF THE RC/BAHCO SULFUR DIOXIDE REMOVAL SYSTEM. *Advan. Chem. Ser., no. 127:161-173, 1973. 7 refs.*

The operating experiences of several Bahco sulfur dioxide removal systems are examined. Sulfur oxide removal technology developed by AB Bahco Ventilation, Enkoping, Sweden, is being successfully applied in 19 commercial installations. Each of these units has exhibited on-stream reliability and high SO_2 absorption efficiency. Bahco design flexibility permits the use of sodium and potassium bases, slurries of calcium and magnesium bases, and less expensive materials such as dolomite, burned limestone, sodium carbonate, and ammonia as potential scrubbing reagents. The process is amenable to by-product recovery of sodium sulfate, sodium sulfite, gypsum, and ammonium sulfate, which reduces the threat of discharging secondary pollutants. The possibilities of reverse fuel switching are also examined: the burning of high- sulfur fuels in conjunction with an SO_2 scrubber is a more economical, less-polluting situation than switching to low-sulfur fuels. Costs are cited. (Author abstract modified) fuels. Costs are cited. (Author abstract modified)

41485 **APTIC NO. 64245**

Beavon, David K.

THE BEAVON SULFUR REMOVAL PROCESS. *Institution of Chemical Engineers, London (England), Northwestern Branch and Salford Univ. (England), Proc. Int. Conf. Control Gaseous Sulphur Compd. Emiss., Salford, England, 1973, 14p. (April 10-12.)*

The Beavon Sulfur Removal process, which reduces sulfur content to less than 100 ppm by converting essentially all the sulfur values to hydrogen sulfide which is then removed by the Stretford Process, is described. Effluent gas from Claus plants contains 15,000 to 30,000 ppm equivalent sulfur dioxide, too high to be acceptable in many areas and required to be reduced in some areas to less than 250 ppm. Conversion by the Beavon process to hydrogen sulfide involves simultaneous catalytic hydrogenation and hydrolysis of various sulfur compounds. Operation of the process is very simple and highly reliable. No soot formation in the reducing gas generating line burner was observed and, consequently, no catalyst deactivation due to carbon deposition. Ten industrial plants are now under construction. (Author abstract modified)

41486 **APTIC NO. 65951**

Beer, J. M. and A. B. Hedley

AIR POLLUTION RESEARCH: REDUCTION OF COMBUSTION-GENERATED POLLUTION. *Inst. of Fuel, London (England), Fuel Environ. Proc. Conf., Eastbourne, England, 1973, p. 167-180. 49 refs. (Nov. 26-29, Paper 15.)*

Research on the reduction of combustion-generated pollutants from mobile and industrial and nonindustrial stationary sources is reviewed with particular emphasis on sulfur oxides, nitrogen oxides, non-combustible particulates, unburned gaseous and particulate matter, and secondary pollutants resulting from the reaction of primary pollutants. Process modification is cited as the most promising control method for most sources and pollutants, with burner design, excess air, combustion chamber aerodynamics, and heat transfer being important control parameters. Two-staged combustion and fluidized-bed combustion show promise for control of nitrogen oxides and sulfur oxides, respectively. Data are given for pollutant emissions from combustion for energy conversion from various sources, estimated 1975 pollutant emissions from combustion of prime fuels for energy conversion in the United States, estimates of smoke and sulfur dioxide pollution in Great Britain resulting from the main uses of fuels, overall NOx emissions in the United Kingdom, unburned carbon loss from pulverized coal-fired boiler furnaces, Aitken nuclei concentrations for different topographical locations, NOx emissions from a high-intensity combuster and from various types of conventional combustion, estimated NOx reduction and control costs for a 1000 MW boiler by selected combustion modifications, cost comparision of fluidized bed combustion with other types of sulfur oxide control processes, emissions from a typical turbofan aircraft engine with low-smoke combustion, and the effect of design and operating variables on spark-ignition, engine exhaust emissions.

41487 **APTIC NO. 64214**

Blumberg, Paul N.

NITRIC OXIDE EMISSIONS FROM STRATIFIED CHARGE ENGINES: PREDICTION AND CONTROL. *Preprint, Combustion Inst., Central States Section, 87p., 1973. 15 refs. (Presented at the Combustion Institute, Central States Section, Spring Meeting, Champagne, Ill., March 27-28, 1973.)*

A model is presented for calculating nitric oxide emissions from stratified charge engines in which the fuel is completely vaporized prior to combustion. The validity of the model is limited to singl chamber geometry. The parameters of the model are fuel type, humidity of inlet air, overall equivalence ratio, stratification function, percent exhaust gas recirculation (EGR), intake manifold pressure, intake manifold temperature, compression ratio, piston connecting rod to crank radius ratio, rpm, and position and duration of combustion in the cycle. Stratification in which the first elements to burn are rich and the last elements are lean in the most effective relative to a uniform air/fuel mixture at overall air/fuel ratios near stoichiometric. Under these conditions, almost all elements in the uniform charge are replaced by elements of lesser NO-producing air/fuel ratios. On the overall rich side, smaller reductions in NO level are possible with rich to lean stratification. However, if the stratification were poorly controlled and lean to rich stratification were to result, large increases in NO emissions would be expected. On the lean side, stratification is not advisable since very close control of the air/fuel distribution is required to prevent increased NO. Nitric oxide control achieved via stratification results in a loss in power and efficiency. The greatest NO reduction near stoichiometric conditions resulted from step distribution functions in which the first half of the charge is rich and the latter half lean. For engines operating with stratification and EGR, increasing the compression ratio and retarding the combustion interval leaves the efficiency unaltered but lowers NO. The effect of mixing the stratified burned gases on efficiency and NO control indicates the existance of an optimal crank angle for dissipating stratification. Most NO activity terminates within 30 deg after the end of the combustion process at all levels of EGR including no EGR. (Author abstract modified)

41488 **APTIC NO. 64062**

Braetsch, Peter, Willi Domalski, and Manfred Behrens

SMOKE ABATEMENT IN THE DESULFURIZATION OF PIG IRON. *(Verfahren zur Minderung der Rauchentwicklung bei der Roheisenentschwefelung und Gemisch zur Durchfuerung des Vefahrens). Text in German. (Stahlwerke Peine-Salzgitter AG, Peine (Germany)) W. Ger. Appl. 2,150,965. 8p., April 26, 1973. (9 claims).*

The development of smoke in the desulfurization of pig iron was reduced by adding soda-cement-fluorite mixtures containing 50-70% sodium metasilicate for fixation of the volatile sodium monoxide formed by decomposition of the soda. A mixture containing soda 63, portland cement 28, and fluorite 9% was suitable for the desulfurization of Fe at 1350-400 C.

41489 **APTIC NO. 63451**

Bratzler, Karl, Alexander Doerges, and Kurt Thormann

WASHING OF GAS MIXTURES TO REMOVE ACID GASES. *(Verfahren zum Auswaschen saurer Gasbestandteile aus Gasen). Text in German. (Metallgesellschaft AG, Frankfurt (West Germany)) W. Ger. Pat. 1,494,800. 3p., July 26, 1973. (Appl. Aug. 29, 1969, 3 claims).*

Acid gases can be removed in a two-stage washing process using an alkanolamine/solvent/water mixture. In the first stage, they are reduced to a partial pressure of 0.8-0.6 kg/sq cm by the solution in N-methyl pyrrolidone, which is regenerated by pressure release. In the second stage, the remaining acid components are removed by chemical absorption in an alkanolamine/water mixture or similar water soluble organic base to which is added a physical solvent. The second stage absorbent is charged to greater than 80% of its maximum capacity, and is regenerated by pressure release, heating, and stripping with steam or air. Addition of physical solvent, preferably N-alkyl pyrrolidone or piperenes with less than or equal to 2 C atoms in the side-chain, reduces the energy required, increases the rate of absorption, and allows a reduction in volume of the second stage absorber. The process is suitable for removing hydrogen sulfide, carbon dioxide, or hydrogen cyanide from gas mixtures such as natural gas.

41490 **APTIC NO. 64004**

Bridgstock, G.

SPECIAL PROBLEMS OF THE SMELTER INDUSTRY. *Society of Engineering Science, Pollut. Eng. Sci. Solutions, Proc. Int. Meet. Soc. Eng. Sci., 1st, Tel Aviv, Israel, 1972, p. 215-223, 1973. 5 refs. (June 12-17.)*

Pollution sources and national ambient air quality standards in the U. S. are reviewed. Industrial processes are the second largest single source of emission. Ferrous and nonferrous smelters produce a sizeable amount of the sulfur oxide pollution from industrial processes. During smelting of nonferrous metals such as copper, zinc, lead, and nickel, the metal is separated from the sulfur and other materials in the concentrate, and sulfur is oxidized to sulfur dioxide. Smelter off-gases contain from 0.25 to 13% SO2. In the past, this pollutant was often released to the atmosphere, but concern about pollution and stricter standards has led to the development of various methods to remove sulfur oxides. Smelter gases containing more than 3.5% SO2 can be used to produce sulfuric acid. An alternative solution is to develop other processes than the traditional pyrometallurgical processes to eliminate high temperature oxidation of sulfur and thus produce less SO2; these hydrometallurgical processes have the disadvantage that they are unable to recover precious metals to the same degree as the smelting processes. Sulfur dioxide removed from stack gases can be converted to sulfur, liquid SO2, or throw away products such as calcium sulfate. A typical copper smelting process is described which produces 8% SO2 in the stack gas. Various methods to control the SO2 emission are discussed.

41491 **APTIC NO. 63851**

Busse, Maria and Ulrich Marmai

SOME FUNCTIONAL AND ENERGETIC CONSIDERATIONS CONCERNING THE RECOVERY PROCESS IN ADSORPTION PLANTS WITH WATER VAPOR DESORPTION. *(Einige funktionelle und energetische Betrachtungen zum Regenerations prozess in Adsorptionsanlagen mit Wasserdampfdesorption). Text in German. 23p., 1973. 6 refs. (Presented at the Verfahrenstechnischen Jahrestagung, Halle, East Germany, June 27-28, 1973.)*

Classical adsorption with activated coal is used for the recovery of valuable vaporous components (e.g., solvents) or for the removal of vapors from waste air. The adsorption process comprises the loading process and the recovering process. The loading process has been extensively dealt with in the existing published literature, therefore the recovery process is discussed in great detail. It comprises the desorption, drying and cooling steps. The ratio between loading and recovery time determines the number of necessary apparatuses. The main quantity of water vapor is consumed for desorption. The load of the activated coal has a major influence on the vapor consumption. With increasing load the absolute vapor consumption rises. For determination of the recovery time the desorption speed must be known. The load prior to desorption has considerable influence on the desorption speed. After vapor desorption, the activated coal must be dried to make it receptive again. Drying curves were determined in the laboratory. Increase of the drying speed through higher temperature of the drying agent raises the operating costs. But it is frequently the best method for intensifying the drying process without interfering with the process rhythm. Higher flow velocities of the drying agent through the coal also improve the drying velocity. But this method has its limits. With the drying curves the drying time can be determined. For an approximation, the function of the drying velocity can be linearized. If the time required for the individual recovery steps is not taken into account, considerable losses of the recovery product and pollutant emissions might be incurred.

41492 **APTIC NO. 63664**

Cantwell, E. N., W. E. Bettoney, and J. M. Pierrard

A TOTAL VEHICLE EMISSION CONTROL SYSTEM. *Proc. Am. Petrol. Inst. Div. Refining, vol. 53:199-233, 1973. 20 refs.*

A total vehicle emission control system is described based on the desirability of achieving ultra-low emission levels for automobiles and the desirability of minimizing fuel consumption penalties. The automotive exhaust emissions standards mandated by the Clean Air Act Amendments of 1970 appear to be more stringent than necessary to attain the ambient air quality standards in major urban areas. Based on trends in ambient air levels, traffic, and automotive emission rates the following standards are adequate to meet ambient air quality standards: carbon monoxide, 15-40 g/m, hydrocarbons 0.4-0.8 g/m, and nitrogen oxides 1.5-3.0 g/m. Current 1973 model standard size cars use 7-20% more gasoline/mi than comparable pre-emission control cars. This penalty in fuel consumption will double if emission controls meeting the 1976 standards mandated by the Clean Air Act are used. If the suggested values were adopted, noncatalytic exhaust emission control systems based on thermal reactors, exhaust gas recirculation, and engine modification could be used. They would permit the continued use of high octane leaded gasoline giving motorists the opportunity to use the lowest cost fuel in high compression, more efficient engines at a cost of only 8% more fuel. Exhaust particulate traps could be used to control Pb particle emissions, if needed. (Author conclusions modified)

41493 **APTIC NO. 65940**

Chandler, Geoffrey

THE OIL INDUSTRY. *Inst. of Fuel, London (England), Fuel Environ. Proc. Conf., Eastbourne, England, 1973, p. 23-40. 35 refs. (Nov. 26-29, Paper 3.)*

Problems and preventive measures associated with the environmental impact of the British oil industry are reviewed in terms of exploration and production, ocean transportation, refining, distribution, and product usage. The principal air pollutant from the burning of sulfur-containing refinery fuel is sulfur dioxide, with other emissions consisting of smoke, dust, nitrogen oxides, and odors. Sulfur oxides are controlled by chimney height and hydrodesulfurization of distillate products. Recirculation of flue gas and the use of staged combustion techniques are employed for reducing nitrogen oxide emissions to the atmosphere. Dusts from catalytic cracking units are controlled by passing the catalyst fines through a series of multistage cyclones. Odors resulting from hydrogen sulfide and mercaptans are destroyed by combustion.

41494 **APTIC NO. 63444**

Charpenet, L. and R. Ponsonnet

NITROGEN OXIDES CONTENTS IN THE EXHAUST GASES OF SPARK-IGNITION GAS ENGINES. *(Teneurs en oxydes d azote dans les produits de combustion d un moteur a gaz a allumage commande). Text in French. Entropie, 9(54):48-53, Nov.-Dec. 1973. 9 refs.*

The effects of the operational parameters of a spark-ignition gas engine model POYAUD by Surgerienne des Construction, powered by commercial propane and Lacq natural gas with 97.4% methane content on the nitric oxide and carbon monoxide formation, were studied. The NO concentrations in the exhaust gases were determined by infrared spectrometry and chemiluminescence. The NO concentration was highest usually under optimum engine operating conditions. A reduction of the air-excess coefficient from 0.9 to 0.8, or an increase of this parameter to 1 for propane and to 1.1 for natural gas, equally reduced the NO formation by about 50%. However, the increased air-excess ratio also resulted in an increased CO emission which would require the use of a catalytic exhaust control. A modification of the ignition timing is not desirable due to its increasing the CO emission. The combustion products of the natural gas contained less NO than did those of propane. While the NO emission from the gas engine varied as a function of the air-excess ratio in the pattern as in a gasoline engine, it was considerably lower for propane, and especially for natural gas, than for the gasoline engine.

41495 **APTIC NO. 63812**

Clemens, David H. and Robert Kunin

REMOVAL OF SULFUR TRIOXIDE AND ACID MIST FROM GASEOUS STREAMS. *(Rohm and Haas Co. Philadephia, Pa.) U. S. Pat. 3,780,500. 4p., Dec. 25, 1973. 7 refs. (Appl. Feb. 15, 1973, 16 claims).*

This invention removes and/or adsorbs sulfur trioxide (SO3) and sulfuric acid mist from gaseous streams using certain macroretricular, weak base, anion exchange resins. Removal from the gaseous stream is accomplished with a class of exchange resins that have extended life, outstanding resistance to oxidation, good capacity for SO3 and good acid demisting qualitites, and also good elution or regeneration characteristics, including good chemical regeneration characteristics. The resin is a macroreticular weak base resin which can be regenerated with an alkaline material. (Author abstract)

41496 **APTIC NO. 64130**

Conser, R. E.

THE SHELL FLUE DESULFURIZATION PROCESS -- HOW DOES IT STACK UP? *Institution of Chemical Engineers London (England), Northwestern Branch, and Salford Univ. (England), Proc. Int. Conf. Control Gaseous Sulphur Compd. Emiss., Salford, England, 1973, 9p. 2 refs. (April 9-12.)*

Stricter air pollution standards are coming, but at present there are numerous variations between states, areas, and countries. With a short supply of low-sulfur crude oil, desulfurization of fuel oil or stack gas is essential. The economics vary between direct and indirect processes depending on the oil being burned. The Shell process of stack gas desulfurization may be a solution to pollution control and can be applied to coal-fired power plants. The cost difference between 300 and 650 mW power plants typically amounts to 0.2-0.25 mills/kWh, while the cost difference between 650 and 1000 mW units is only about 0.1 mil/kWh. A reduction in the sulfur emission standard from 1.0 to 0.3 wt% equivalent in fuel oil would result in a difference in power plant costs of about 0.35-0.4 mills/kWh. Shell flue gas desulfurization costs for a 650 MW power plant using Kuwait oil would be 2.10 mills/kWh and using Iranian Heavy oil would be 1.65 mills/kWh. The process uses a static packed bed to accept sulfur dioxide from flue gas. The process is described in detail. Copper oxide is an outstanding acceptor. The chemistry of acceptance and regeneration, processing of regeneration off-gas to produce elemental sulfur or other recoverable sulfur compounds, the demonstration unit, the full-scale unit, and process selection factors are discussed.

41497 **APTIC NO. 65960**

Cross, Frank L., Jr. and Franklin B. Flower

CONTROLLED AIR INCINERATORS. *Louisville Univ., Ky., Speed Scientific School, Environ. Eng. Sci. Conf., Proc. 3rd Annu. Meet., Louisville, Ky., 1973, p. 661-684. 6 refs. (March 5-6.)*

The development and design of controlled air incinerators are discussed. By reducing the quantity of air supplied to the fuel bed to below theoretical, it is possible to prevent the entrainment of particulates from the refuse bed, because the air velocity below, through, and at the top of the refuse bed is kept below that necessary to lift particulates from the bed and carry them out of the incinerator combustion chamber. Since the fuel bed is supplied with less than the theoretical amount of air required for complete combustion, much of the refuse is destroyed through pyrolysis. Controlled air incinerators are frequently able to meet the restrictive emission standard of 0.1 grains of particulate matter/cu ft at 50% excess air when burning general refuse without the use of washing devices on their discharge gases. Available commercial units are described including their design features, operating procedures and requirements, and typical air pollution emissions.

41498 **APTIC NO. 63757**

Dautzenberg, Frits M., Herman W. Kouwenhoven, and Jaap E. Naber

SULFUR OXIDE ACCEPTORS HAVING HIGH INITIAL ACTIVITY WITH GOOD CHEMICAL AND PHYSICAL STABILITY AND PROCESS FOR THEIR PREPARATION. *(Shell Oil Co., New York) U. S. Pat. 3,776,854. 4p., Dec. 4, 1973. 5 refs. (Appl. Dec. 1, 1971, 16 claims).*

Highly active copper-containing acceptors suitable for use in removing sulfur oxides from waste gases can be prepared by impregnating an alumina-containing support which has been calcined at a temperature above 780 C with a water-soluble compound of aluminum, titanium, and/or zirconium either prior to or simultaneously with impregnation of a copper compound. The acceptors have a high initial activity, very good chemical and physical stability, and retain their good activity upon aging, advantages over acceptors made by other methods. (Author abstract modified)

41499 **APTIC NO. 64046**

Davies, George F. and Richard H. Crow

TURBOJET AIRCRAFT ENGINE TEST CELL POLLUTION ABATEMENT STUDY (FINAL REPORT). *Braun (C. F.) and Co., Alhambra, Calif., Naval Civil Engineering Laboratory Contract N62399-72-C-0020, Proj. 4678-P, Proj. YF 38.554.001.01.008, CR 74.001, 92p., June 1973. 11 refs.*

NTIS, DDC: AD-768 287

The results of a survey and analysis of the application of conventional air pollution abatement systems to the exhuast gas from jet engine test cells are summarized. The following categories of methods for gas treatment were investigated: wet scrubbers, incinerators, electrostatic precipitators, filters, and dry inertial collectors. The installed capital costs, the yearly operating costs, and the effectiveness for particulate removal were evaluated for eight systems. Detailed cost analyses were made on two systems and rough cost analyses were made on the other six systems. The least costly methods for meeting present Bay Area emission standards are water scrubbing systems. One of the most attractive which uses Koch Flexitrays is developed in detail. There are three potential disadvantages to wet scrubber systems: they produce a liquid effluent containing a relatively high concentration of dissolved solids; the stack gas may still contain some odorous organic compounds; and a visible water vapor plume is often produced. A section on research and development suggestions directed toward minimizing smoke formation is included. (Author abstract modified)

41500 **APTIC NO. 64298**

Dence, Geoffrey Roy

IMPROVEMENTS IN OR RELATING TO AIR FILTERS. *(Provenair Ltd., Hertfordshire (England)) Brit. Pat. 1,336,648. 10p., Nov. 7, 1973. (Appl. March 30, 1971, 12 claims).*

A self cleaning air filter, particularly suited for removal of asbestos dusts, is described which accommodates a large number of filter elements within a single filter unit as opposed to prior art designs requiring several individual filter units. The device consists of an inlet and outlet chamber, a filter sleeve supporting wall arranged to separate the inlet and outlet chambers, several filter sleeves whose interiors are connected at one end of each sleeve to respective apertures in the filter sleeve supporting wall in an array of crosswise rows of sleeves over a length of the filter sleeve supporting wall, a gantry arranged in the outlet chamber across the array, several reverse air flow nozzles arranged on the gantry, and a blower unit for supplying air to the nozzles.

41501 **APTIC NO. 63831**

Dorr, Karl-Heinz, Hugo Grimm, and Rolf Kola

SYSTEM FOR THE LIQUID-PHASE REMOVAL OF A COMPONENT FROM THE GAS STREAM ESPECIALLY THE ABSORPTION OF SULFUR TRIOXIDE IN SULFURIC ACID. *(Metallgesellschaft Aktiengesellschaft, Frankfurt am Main (Germany)) U. S. Pat. 3,780,499. 8p., Dec. 25, 1973. 3 refs. (Appl. Oct. 12, 1971, 11 claims).*

A process is described for absorbing gaseous components from a fluid such as a gas stream with the aid of absorbing liquids, i.e., a process for the treatment of a gaseous phase in the liquid phase so as to dissolve a component of the gaseous phase in the liquid phase. Particularly, the invention relates to the absorption of sulfur trioxide or moisture from the gases containing them, e.g., the gaseous effluent of a contact-catalysis stage converting sulfur dioxide to sulfur trioxide, using sulfuric acid as the absorbing phase. It makes use of a uniflow vertical venturi absorber followed by a turbulencing device or horizontal venturi and a counterflow column absorber or tower. This system optimizes the intimate contact of the gas with the liquid to achieve efficient thermal and material exchange in the shortest possible time and a minimum of energy loss in maximum throughput and a low-pressure drop.

41502 **APTIC NO. 63800**

Dreschel, Herbert, Karl-Heinz Dorr, Hugo Grimm, and Gustav Roweder

PROCESS OF CATALYTICALLY REACTING SO2 TO FORM SO3 AND OF PRODUCING SULFURIC ACID. *(Metallgesellschaft Aktiengesellschaft, Frankfurt am Main (Germany)) U. S. Pat. 3,780,166. 9p., Dec. 18, 1973. 6 refs. (Appl. July 8, 1969, 8 claims).*

A process of catalytically reacting the SO2 content of moist gases to form SO3 in catalyst plants comprising a plurality of catalyst trays and in which the resulting SO3 contents is condensed between the catalyst trays to form sulfuric acid is described. The SO3-containing gas leaving the first of two successive stages is tranferred along a closed flor path into the second stage. A partial stream is separated from the transferred stream and cooled, and SO3 is condensed from the partial stream. The stream following the condensing is combined with the balance of the transferred steam and the combined stream is introduced into the second catalyst stage. The invention reduces the capital expenditure and operating costs involved in the removal of the SO3 content of the gases between the individual catalyst trays in dependence on the desired total conversion of SO2 to form SO3 and eliminates the need for interstage heat absorbers.

41503 **APTIC NO. 63598**

Durandet, J.

FLUE GAS TREATMENT. *(Traitement des fumees de combustion). Text in French. Ind. Petrole 4(2):31-39, 1973.*

Full-scale processes for flue gas desulfurization are described. Dry methods use dolomite or limestone injected into the combustion chamber for the capture of sulfur dioxide and part of sulfur trioxide at rates of about 40%. Subsequent low- temperature scrubbing with water increases the separation efficiency to 80-90%. Adsorption is also possible in fluidized-bed adsorbents. Wet type desulfurization requires cooling the flue gases to the dew point for subsequent adsorption of SO2 and SO3 by basic and possibly acidic solutions. The wash liquid is regenerated to obtain elemental sulfur, sulfuric acid, or sulfates as end products. A process developed by the Institute Francais du Petrole uses ammonia for the removal of sulfur, and subsequent conversion of the scrubbing liquid to obtain elemental sulfur with hydrogen sulfide, ammonia, and water.

41504 **APTIC NO. 63427**

Dwyer, F. G. and W. A. Stover

OXIDATION CATALYSTS IN CATALYTIC CONTROL DEVICES. *Preprint, Mobile Research and Development Corp., Paulsboro, N. J., Research Dept., 13p., 1973 (?). 2 refs.*

Oxidation catalysts for use in catalytic control devices on automobiles are discussed. Catalysts are tailored to meet the stringent exhaust standards specified by the Environmental Protection Agency in 1971 for the original 1975-1976 goals. These catalysts are either supported noble metal or noble metal mixtures. They ignite at a relatively low temperature, 200-400 C because the combination of low heat capacity and low temperature activity effectively reduces hydrocarbon and carbon monoxide emissions during the initial or cold start portion of the CVS cycle. Improved catalysts are being developed to achieve lower heat capacity and better low temperature activity. Future catalyst requirements include low cost and disposability; physical and catalytic durability for more than 15,000 mi; ability to give reasonable performance with leaded gasoline; reduced activity to produce sulfur dioxide and sulfate emissions; and less hazardous products of attrition.

41505 **APTIC NO. 64260**

Earl, Christopher B. and Brian H. Potter

THE WELLMAN-LORD SULFUR DIOXIDE RECOVERY PROCESS. *Institution of Chemical Engineers, London (England), Northwestern Branch and Salford Univ. (England), Proc. Int. Conf. Control Gaseous Sulphur Compd. Emiss., Salford, England, 1973. 18p. (April 10-12.)*

The Wellman-Lord Sulfur Dioxide Recovery Process is described and the current status of this technology is reviewed. It has been successfully commercialized in the U. S. and Japan. The eleven emission sources controlled by the process include sulfuric acid plants, Claus plants, and oil-fired boilers. The process is based on a sodium sulfite/bisulfite cycle. The regeneration operation can proceed with a constant high percentage of bisulfite in solution permitting a considerable reduction in the stripping steam requirements. The inherent advantage of the process is that the absorption system can be physically separated by a large distance from the regeneration system. Thus it is practical to treat gases for more than one plant by installing separate absorbers for each source of SO2, with all the absorbers being supplied by a common regeneration system. The high-purity SO2 produced by the process can be used in several different ways. For a power plant, sulfuric acid and elemental sulfur appear to be the most logical final end products. The application to large fossil fuel-fired steam generating plants is reviewed and capital and operating costs for a specific application are included.

41506 **APTIC NO. 65939**

Ezra, D. J.

THE COAL INDUSTRY. *Inst. of Fuel, London (England), Fuel Environ. Proc. Conf., Eastbourne, England, 1973, p. 9-22. 5 refs. (Nov. 26-29, Paper 2.)*

The British coal industry is reviewed, with particular emphasis on its environmental impact. Topics covered include: exploration and mining, air pollution from collieries, effluent discharges, disposal and utilization of solid wastes, open-cast mining, coal processing, coal marketing and utilization, and future developments in the industry. Smoke, grit, and dust emissions are minimized by electric operation of the collieries and by the use of smokeless fuels produced in fluidized beds, bituminous coal burning, closed appliances. specialized furnaces and kilns, open screw feeders, dust extraction hoods, and water sprays. The National Coal Board is researching various methods of coal desulfurization, including solvent extraction, fluidized-bed combustion with sulfur recovery, and coal gasification.

41507 **APTIC NO. 63759**

Faber, George E. and Frank F. Kates

CLOSED SYSTEM INTERNAL COMBUSTION ENGINE. *(Krun Corp., Sante Fe Springs, Calif.) U S. Pat. 3,779,013. 6p., Dec. 18, 1973. 5 refs. (Appl. Oct. 30, 1972, 13 claims).*

A closed internal combustion engine is described in which the exhaust gases are passed through a catalytic condenser for conversion and/or condensation of the products of combustion into various liquids and solids which are removed from the condenser. The remaining and/or newly formed gases are recycled to the cylinders of the engine for further combustion and/or conversion. The system is operable fully closed with no gaseous exhaust to the atmosphere, with the solids from the condenser being removed by a filter, and with the liquids being received in a storage tank. This engine could use various types of readily available hydrocarbon fuels, including gasoline, diesel fuel, liquefied petroleum gas, or alcohol. This engine totally eliminates air pollution caused by internal combustion exhaust. (Author abstract modified)

41508 **APTIC NO. 65869**

Fleming, Donald K. and John C. Sharer

REGENERATIVE REACTOR FOR NOX ABATEMENT (FINAL REPORT). MARCH 1972-DECEMBER 1972). *Inst. of Gas Technology, Chicago, Ill., Army-Picatinny Arsenal Contract DAAA 21-72-C-0455, Proj. AMCMS 4932.05.4114, Rept. 8935, 156p., May 1973. 36 refs.*

NTIS, DDC: AD 762605

A novel reactor, capable of regenerating heat of reaction into the inlet stream was analyzed for application to nitrogen oxide reduction in nitric acid tail gas. The process was evaluated thermodynamically and kinetically over conventional catalysts. The device was also simulated mathematically, and isothermal bed characteristics were obtained. The simulated unit was also demonstrated with bench-scale hardware. Satisfactory performance was achieved on feed streams that could not otherwise be processed in single reactors. The rotary regenerative reactor overcame the problems of previous NOx abatement processes which required a relatively low operating temperature for the catalysts and a high temperature for the reaction initiation. It also permitted operation with relatively high oxygen concentrations in the tail gas with maximum control of the process. The reactor uses the exothermic heat of the methane-oxygen combustion to preheat the inlet gases, absorbing the heat of the reaction from the reacting gases. Regenerative heat exchange is capable of high efficiency and is particularly amenable to the honeycomb catalysts conventionally used in the reacting system. (Author abstract modified)

41509 **APTIC NO. 64007**

Forsten, Irving

EXPLOSIVE INCINERATION. *Society of Engineering Science, Pollut. Eng. Sci. Solutions, Proc. Int. Meet. Soc. Eng. Sci., 1st, Tel Aviv, Israel, 1972, p. 298-303, 1973. (June 12-17.)*

The current method of disposing of scrap and waste explosives and propellants is by open burning. This causes air and water pollution, uncontrolled burning operation, delays, inefficiency of disposition due to weather, and hazardous exposure of personnel. Since most states have regulations barring open burning, this open burning is therefore operating under temporary waivers. However, emission controls require that new technology be developed to enable these wastes to be incinerated with minimal pollution in a safe manner. Three types of incinerators are being developed to provide pollution-free incineration -- a vertical induced draft, a fluidized-bed combustor, and a rotary kiln. This research program is discussed. Effects of waste material composition on exhausts, effects of various operating variables on exhausts, and design of the incinerators are described.

41510 **APTIC NO. 64258**

Furkert, H.

THE WET CHEMIEBAU PROCESS FOR REMOVAL OF SULPHUR COMPOUNDS. *Institution of Chemical Engineers, London (England), Northwestern Branch and Salford Univ. (England), Proc. Int. Conf. Control Gaseous Sulphur Compd. Emiss., Salford, England, 1973, 10p. (April 10-12.)*

Waste gas purification at Chemiebau Chemical plants is discussed. Plant efficiency lies between 95.8 and 96.3% for all sulfur compounds and between 96.4 and 97.3% for sulfur dioxide. To recover the ammonium sulfate and the sulfite SO2 in useful concentration the washing solution is mixed with sulfuric acid and degasified. At temperatures between 900-1100 C and 3% vol/vol excess O2, the ammonium scrubbing solution is completely burned to N2, steam, and SO2, in a very short time, with no undesirable nitric oxides formed. The sulfur content of the scrubbing solution can thus be utilized and at the same time the ammonia is decomposed. In the purification of flue gas, a process has been patented in which the wash solution and sulfuric acid which is added is sprayed downwards into an acid proof lined steel tower, up which flows hot decomposition gas, in order to transform the sulfite to sulfate until it is saturated or a solid sulfate slurry has formed. Advantages and disadvantages of flue gas purification by water and ammonia are presented. The process results in a loss of thermal buoyancy at stack outlets. However, the high purification efficiency of scrubbing with ammonia and water compensates for this. Costs of this process are generally lower than those of other processes.

41511 **APTIC NO. 63810**

Gadefelt, Bengt Georg

SYSTEM FOR CONTROLLING THE SUPPLY OF AIR TO AN INTERNAL COMBUSTION ENGINE. *(Saab-Scania Aktiebolag, Sodetalje (Sweden)) U. S. Pat 3,775,971. 5p., Dec. 4, 1973. 11 refs. (Appl. March 28, 1974, 4 claims).*

This invention relates to a supercharged internal combustion engine by which the supply of air to respective engine cylinders in controlled and compensated in response to such engine parameters as gas pressure and temperature, and which enables a high engine power to be obtained over a wide range of engine speed while considerably reducing the content of harmful combustion products in the engine exhaust gases. An electrically driven air pump is arranged to feed supplementary air to the afterburner, and recirculation means are provided for returning a portion of the exhaust gases from the afterburner to the engine via the exhaust turbine. In this way the torque characteristic of the engine is improved, and the content of contaminating solid products in the exhaust gases is reduced.

41512 **APTIC NO. 63782**

Gartner, Joseph J.

INERNAL COMBUSTION ENGINE POLLUTION CONTROL DEVICE. *(Assignee not given.) U. S. Pat. 3,779,221. 11p., Dec. 18, 1973. 10 refs. (Appl. Nov. 23, 1971, 12 claims).*

A pollution control device for automobile engines is described having a housing adapted to receive the blowby gases from the engine crankcase. The housing has a filter assembly for filtering the blowby gases and inlet means for mixing the gases with air to increase oxidation of the pollutants in the gases. The treated gases are supplied to the engine intake manifold through the positive crankcase ventilation valve. Alternate embodiments of the invention provide for heating the blowby gases in the housing, eliminating the need for the positve crankcase ventilation valve, and for sonic mixing of the air and blowby gases in the housing. The invention is a pollution control device reducing airborne pollutants derived from crankcase emissions, eliminating repeated engine tuneups and other costly maintenance. (Author abstract modified)

41513 **APTIC NO. 63540**

Gottler, Hans

PURIFICATION OF WASTE GAS FROM GLASS POLISHING. *(Verfahren zum Reinigen Abgesaugter Daempfe aus einer Saeurepolieranlage fuer Glasgegenstaende). Text in German. (Achthal-Maschinenbau-GmbH, Neukirchen (Germany)) W. Ger. Pat. Appl. 2,160,313. 4p., June 7, 1973. (2 claims).*

Silicon tetrafluoride-containing vapors from an acid polishing plant for glass objects were purified by scrubbing with sulfuric acid which was subsequently recycled to the polishing bath.

41514 **APTIC NO. 64256**

Grancher, Pierre and Fred. C. Riesenfeld

THE SNPA-DEA PROCESS FOR THE DESULFURIZATION OF HIGH PRESSURE GASES. *Institution of Chemical Engineers, London (England), Northwestern Branch and Salford Univ. (England), Proc. Int. Conf. Control Gaseous Sulphur Compd. Emiss., Salford, England, 1973, 10p. 9 refs. (April 10-12.)*

The gas desulfurization process discovered by Societe Nationale des Petroles d Aquitaine (SNPA), using diethanolamine (DEA) as a solvent is described. The specific improvements of prior technology, contributed by SNPA, fall into the following areas: solution circulation rate and rich solution loading; solution strength in terms of DEA concentration; absorption temperature; stripping steam requirements as related to treated gas purity; and solution conditioning with respect to removal of impurities. One very important discovery of SNPA during the development of the DEA process was the strong influence of solution purity on proper operation, especially with respect to foaming and corrosion. By providing a highly effective filtration system using powdered active carbon besides the normal filter aid in a pressure leaf type filter, SNPA succeeded in keeping the solution essentially free of solids and degradation products. Foaming was largely eliminated and corrosion was reduced to a minimum. The basic flow scheme used is that of a conventional absorption-regeneration cycle incorporating heat exchange between the liquid streams. The plants can operate for many years without significant corrosion of carbon steel equipment when certain precautionary measures are taken. The process is capable of producing a treated gas meeting pipeline specifications and, in many instances, it has proved to be better than other gas purification processes.

41515 **APTIC NO. 64252**

Groenendall, W. and H. C. A. van Meurs

NEW SHELL PROCESS FOR CLAUS OFF GAS DESULFURIZATION. *Institution of Chemical Engineers, London (England), Northwestern Branch and Salford Univ. (England), Proc. Int. Conf. Control Gaseous Sulphur Compd. Emiss., Salford, England, 1973, 9p. 3 refs. (April 10-12.)*

The Shell Claus Off Gas Treating (SCOT) process has been developed for those cases where only the Claus tail gases have to be desulfurized. The processes possible for the desulfurization of Claus tail gases can be classified as follows: low-temperature Claus processes, and conversion/concentration processes. The sulfur recovery in the extra Claus stage is limited by: chemical equilibrium and how closely equilibrium is approached; sulfur losses as carbonyl sulfide and carbon disulfide which are not converted; and losses of sulfur vapor and entrained liquid sulfur. In the conversion step the various sulfur compounds in the tail gas are converted into one compound. In the subsequent concentration step this compound is isolated and (mostly) converted into sulfur. In this type of process a very high degree of sulfur removal from the tail gas, even exceeding a total sulfur recovery of 99.8%, is possible. The new process essentially consists of a reduction section and an amine absorption section. In both sections only proven equipment is used familiar to refinery and gas purification plant operators, so that it can be easily introduced. It is reliable, flexible, and easy to operate. It does not give rise to secondary pollution or waste disposal problems. In the reduction section all sulfur compounds together with free sulfur in the Claus tail gas are completely reduced to hydrogen sulfide with hydrogen or hydrogen together with carbon monoxide over a cobalt/molybdenum on alumina catalyst at a temperature of about 300 C. Carbon monoxide in the presence of steam, is equivalent to H2 as a reducing agent, while its reactivity is higher.

41516 **APTIC NO. 64251**

Grover-Thomas

CLEAN AIR SO2 RECOVERY PROCESS. *Institution of Chemical Engineers, London (England), Northwestern Branch and Salford Univ. (England), Proc. Int. Conf. Control Gaseous Sulphur Compd. Emiss., Salford, England, 1973. 3p. (April 10-12.)*

The Clean Air Sulfur Dioxide Recovery Process is designed to reduce noxious gas emission from Sulfuric Acid, Power Plants, and Incinerator Claus Plants for effluents. The Process involves absorption, stripping, and recycle streams, using a proprietary absorbent. The stack gas is discharged to the atmosphere with an SO2 content of less than 150 ppm and greatly reduced concentrations of SO3 and H2SO4. It can work well on any incinerated gas or power plant stack.

41517 **APTIC NO. 64217**

Hausberg, Gerhard

INDUSTRIAL EXHAUST GAS SCRUBBER. *(Anlage Zur Reinigung von industriellen Abgasen). Text in German. (Bischoff, Gottfried Bau kompl. Gasreinigungsund Wasserueckkuehlanlagen KG, Essen (Germany)) W. Ger. Pat. Appl. 2,329,968. 3p., June 13, 1973. (1 claim).*

For extraction of sulfur dioxide, the dirty gas is fed downwards into the upper chamber of the scrubbing tower (using lime scrubbing solution) in whose sloping deck are a number of venturi annular scrubbing nozzles and within which are a number of separate spray nozzles one above the other each with independent feed pipe. The lower chamber also has a sloping drain floor and has the clean gas outlet. Partly used liquid drained from the lower compartment passes to a buffer tank from which it is pumped to a manifold connected by valves to the individual nozzle feed lines which are also connected by valves to the main feed pump for fresh liquid.

41518 **APTIC NO. 63758**

Hazzard, Noel D. and William M. Anderson

METALLIC RECOVERY SYSTEM. *(Air Preheater Co., Inc., Wellsville, N. Y.) U. S. Pat. 3,780,676. 5p., Dec. 25, 1973. 5 refs. (Appl. May 8, 1972, 8 claims).*

A conversion system for waste having organic and inorganic components is described wherein the organic conponents are pyrolyzed in an oxygen-free atmosphere to preclude thhe oxidation of the inorganic constituents. An afterburner provides the heat necessary for burning pyrolyzed gases and the carbonacious particulate matter produced in the pyrolyzing chamber. The pyrolyzing chamber is maintained at a suitable temperature for properly pyrolyzing waste material by tempering hot gases exhausting from the afterburner with cool ambient atmosphere, and then directing the mixed gases back over the pyrolyzing chamber. This method does not give off oxides of metals as conventional starved-air incinerators do. (Author abstract modified)

41519 **APTIC NO. 64025**

Hishinuma, Yukio, Norio Arashi, and Zensuke Tamura

APPARATUS FOR DESULFURIZING STACK GAS. *(Vorrichtung zum Entschwelfeln von Rauchgas). Text in German. (Hitachi Ltd., Tokyo (Japan)) W. Ger. Appl. 1,234,275. 12p., Feb. 1, 1973. (4 claims).*

An apparatus for desulfurizing stack gas is described. The adsorption capacity is efficiently improved by dividing the adsorption column into segments, which are used alternatively for either adsorption or desorption. The column, which is wider than high, has a common water-cooled inlet, and a common outlet for the desulfurized gas. The desorption is carried out by water spraying, and repeated to increase the SO2 content to usable concentration.

41520 **APTIC NO. 65962**

Horlander, L. A., Jr.

ODOR AND PARTICULATE REMOVAL FROM DISTILLERY BY-PRODUCTS GAS FIRED DRYER STACKS. *Louisville Univ., Ky., Speed Scientific School, Environ. Eng. Sci. Conf., Proc. 3rd Annu. Meet., Louisville, Ky., 1973, p. 699-713. (March 5-6.)*

The removal of odor and particulates from distillery by-products gas fired dryer stacks is described. Stack emissions of two gas fired by-products dryers were causing odor and particulate complaints in the community. Each stack discharged 14,000 cfm of moisture laden air, products of combustion, and a slight amount of particulate matter not removed from the air stream by the cyclone separator. At least 50 compounds were present in the stack gases. A full size wet scribber unit was designed to handle the flow of gases from both dryers, and with a special control system, can be throttled to handle the flow from one dryer. Details of the operation and control systems are described. The total cost of the air pollution control project including equipment, building changes, and installation was $144,000.

41521 **APTIC NO. 64243**

Houghton, R. and J. S. Gerrard

CLEAN AIR BY CAT-OX. *Institution of Chemical Engineers, London (England), Northwestern Branch and Salford Univ. (England), Proc. Int. Conf. Control Gaseous Sulphur Compd. Emiss., Salford, England, 1973, 20p. 2 refs. (April 10-12.)*

The development of Monsanto's system for pollution control from the pilot plant stages to commercial operation, called the Cat-Ox process, is described. sulfur dioxide is removed from the gases and converted to sulfuric acid, in effect releasing a corresponding amount of sulfur for other uses. The principle of the process is to catalytically oxidize SO2 to sulfur trioxide and then absorb the latter to produce H2SO4. The two Cat-Ox systems are the Integrated and the Reheat systems. The Integrated system is built into the boiler plant and becomes an integral part of the boiler system. It generally offers higher overall plant efficiency capital and operational cost saving but has the disadvantages of operational problems and requires a special design of boiler plant involving increased capital cost for boiler plant. The Reheat system is designed to be independent of the equipment associated with flue gas generation and thus can be easily added to the existing plant. A process description and operating costs are provided. The advantage of the system is that it takes a pollutant SO2 and converts it into the valuable industrial commodity H2SO4, but at a cost which is at present possibly uneconomic, but which could be made more attractive by choosing large modern steam generation units, having very high sulfur coal.

41522 **APTIC NO. 64257**

Houston, Peter S. and George R. Koehler

A CASE HISTORY OF THE APPLICATION OF THE CHEMICO MGO SULPHUR RECOVERY PROCESS TO A 150 MW POWER STATION. *Institution of Chemical Engineers, London (England), Northwestern Branch and Salford Univ. (England), Proc. Int. Conf. Control Gaseous Sulphur Compd. Emiss., Salford, England, 1973, 30p. (April 10-12.)*

A Sulfur Dioxide Recovery Plant using the Chemico Magnesium Oxide Sulfur Recovery Process is described. The process may be divided into two major sections. The first involves the absorption of sulfur dioxide in a magnesia slurry, as a result of which magnesium sulfite is formed. The second involves the subsequent calcination of the sulfite to regenerate magnesium oxide for recycle to the absorption process and to produce sulfur dioxide, for use in the manufacture of sulfur, liquid sulfur dioxide, or sulfuric acid. The manner in which this integrated process has been applied to the existing 150 MW No. 6 Unit at Boston-Edison's Mystic Station in Everett, Mass. and to the existing sulfuric acid plant owned and operated by the Essex Chemical Co. in Rumford, R. I. is described. The program of work for this project was divided into two phases. Phase I has been successfully completed. This involves the design, construction, and start-up of the facilities. The results of initial operation are described. Phase II will entail the operation and testing of the facilities over a 2-yr period to establish optimum operating conditions, the reliability of equipment, and process economics. The system operates satisfactorily and without adversely affecting normal boiler operation. It thereby permits optimum power generation to be achieved with maximum control of sulfur dioxide pollution and without the production of a secondary effluent. (Author abstract)

41523 **APTIC NO. 64253**

Hughes, R. and N. J. James

SOME CONSIDERATIONS IN THE CHOICE OF ABSORBENT FOR SO2 REMOVAL BY SOLIDS. *Institution of Chemical Engineers, London (England), Northwestern Branch and Salford Univ. (England), Proc. Int. Conf. Control Gaseous Sulphur Compd. Emiss., Salford, England, 1973, 12p. 3 refs. (April 10-12.)*

Some considerations in the choice of absorbent for SO2 removal by solids are presented, centering around two pivotal features, the capacity of the absorbent and the rate of absorption. The structure best suited for absorption should have a pore structure comprising wide transport pores in which bulk diffusion occurs with small Knudsen type pores leading off these transport pores. The latter are necessary for a high absorptive capacity. If these arterial transport pores are not present and only a fine structure develops then reaction will tend to stop after a short period due to blocking of these pores by solid products formed from SO2. The methods of mathematical modelling are useful insofar as they enable prediction of effects such as temperature rise and concentration variation by computational methods. Modelling reveals the limits of the controlling regimes which are important to intraparticle temperature gradients which could cause sintering and to external conditions which effect the controlling regime. It must be ascertained whether regeneration is possible in order to avoid solid wastes and expensive absorbent costs, and to determine availability and economics of the absorbent. Finally, consideration needs to be given to the necessary modification the absorbent would require in existing plants to work maximum effectiveness.

41524 **APTIC NO. 64284**

Jordan, Wenzel von, Albert Kleinhenz, Jean Wiemer, and Horst Hemmerling

GAS WASHING VESSEL. *(Ein-oder mehrstufiger Waescher). Text in German. (Metallgesellschaft, Frankfurt (Germany)) W. Ger. Pat. Appl. 2,224,519. 8p., Nov. 29, 1973. (2 claims).*

A single or multi-stage gas washer for wet treating exhaust gases in a round or square container is described. The discharge opening is formed by a pair of annular members arranged in a central opening of the dividing floor and in the interior of the bath. The members are cylindrical or polygonal rings, one of which is adjustable up and down. Large quantities of gas can be cleaned in a relatively small plant to standards meeting with the clean air legislation. The rubber is particularly suitable for use in high pressure blast furnaces.

41525 **APTIC NO. 63811**

Karlowitz, Bela

METHOD FOR EMISSION CONTROL FOR SPARK IGNITION ENGINES. *(Assignee not given.) U. S. Pat. 3,776,212. 8p., Dec. 4, 1973. 12 refs. (Appl. Oct. 22, 1970, 16 claims).*

A method and apparatus for operating an internal combustion spark ignition engine in a manner to reduce the harmful constituents of the exhaust is described. The engine is operated, except during peak power requirement, with very lean air-fuel mixtures. The loss of power generally accompanied by lean air-fuel mixtures due to slow burning is avoided by supplying turbulence of proper intensity of the burning mixture. The turbulence is supplied by constructing a combustion chamber divided into main and auxiliary sections joined by an orifice. By selecting the proper orifice size and the proper ratio of the volumes of the main and auxiliary sections sufficient turbulence can be provided to burn the lean air-fuel mixture within normal crank angles. It is possible, according to this invention, to operate an internal combustion spark engine during both normal and peak power periods so the exhaust emissions contain little, if any, lead or other anti-knock chemicals which are very undesirable pollutants. It also reduces carbon monoxide, nitric oxide, and hydrocarbons.

41526 **APTIC NO. 64204**

Kennedy, David Colin and Joannis Paleos

POLYMERIC ADSORBENTS FOR COMBATING AIR POLLUTION BY ORGANIC COMPOUNDS. *(Verfahren zur Bekaempfung der Luftverschmutzung durch organische Verbindungen mittels polymerer Adsorbentien). Text in German. (Rohn and Haas Co., Philadelphia, Pa.) W. Ger. Pat. Appl. 2,258,298. 47p., June 14, 1973. (20 claims).*

An adsorbent material with a porosity of 30-70% and specific surface of 100-900 sq m/g, suitable for the removal of organic compounds from air, consists of a trimethylolpropanetrimethacrylate copolymer with methyl methacrylate, diacetoneacrylamide, or butyl methacrylate.

41527 **APTIC NO. 61067**

Kojima, Takeshi, Okiyasu Yoshioka, Masami Shimazaki, Akira Ofuka, and Ryoichi Ito

A METHOD OF USING AMMONIA AND CARBONIC ACID GAS IN CIRCULATION. *(Ammonia, tansan gasu no junkan shiyoho). (Kanegafuchi Chemical Industry Co., Ltd., Osaka (Japan)) Japan. Pat. Appl. 55434-1971. March 22, 1973. (Appl. July 23, 1971, claims not given). Translated from Japanese, 7p.*

A method for synthesizing DL-methionine from beta-methylthiopropionaldehyde which is derived using 5-(beta-methylthioethyl)hydantoin as the intermediate is described in which ammonia and carbonic acid gas (carbon dioxide) are circulated. A reaction solution consisting of beta- methylpropionaldehyde, carbonic acid gas, and either ammonia, ammonium bicarbonate, or ammonium carbonate, as well as hydrocyanic acid or one of its salts, is caused to react in a closed system. Caustic soda is then added to the reaction solution and is subjected to hydrolysis at a high temperature and high pressure. The ammonia, carbonic acid gas, and steam produced are condensed, and the condensate is stored in a storage tank. The uncondensed carbonic acid gas is stored in a gas holder. The concentrated liquid left from the hydrolysis is neutralized in acid, and free methionine is produced. Simultaneously, the carbonic acid gas which is produced is recovered and returned to the reaction solution together with the condensate and the uncondensed carbonic acid gas to be used in circulation.

41528 **APTIC NO. 63797**

Komakine, Chukei

METHOD FOR INHIBITING THE FORMATION OF MALODORS FROM POULTRY FARMS. *(Assignee not given.) U. S. Pat. 3,776,188. 4p., Dec. 4, 1973. 4 refs. (Appl. June 29, 1971, 2 claims).*

The coarse powders of dried ferrous sulfate hepta-hydrate are used to substantially eliminate the offensive stench from the accumulation of dropping in fowl houses. The powder is preferably used in the form of a mixture with some fly ash or dried fine powders of zeolite for ease of dusting, and generation of the offensive odor is substantially inhibited by dusting the floor of fowl houses with the powder in advance. The treated droppings can be effectively utilized as an excellent fertilizer or feedstuff for fowl, fish, and domestic animals. (Author abstract)

41529 **APTIC NO. 64247**

Kovacic, J. E. and H. A. Grosick

THE KOPPERS VACUUM CARBONATE PROCESS. *Institution of Chemical Engineers, London (England), Northwestern Branch and Salford Univ. (England), Proc. Int. Conf. Control Gaseous Sulphur Compd. Emiss., Salford, England, 1973. 11p. (April 10-12.)*

The Koppers Vacuum Carbonate Process for desulfurization of coke oven gas is described as an adsorption-desorption process in which the enriched sodium carbonate solution is regenerated with steam vapor at a reduced pressure instead of by air at atmospheric pressure. This change almost completely eliminates the formation of thiosulfate and thiocyanate salts. The acid gases are recovered for further processing after condensing in a series of vapor condensers to recover the water vapor. The process features a number of advantages that were proven in several American coke plants. These are reliable performances with a minimum of labor at a relatively low capital cost, no seriuos corrosion problems, minimum effluent disposal, utilization of coke plant waste heat to lower operating costs, and the production of good quality sulfur product in liquid form that is easy to handle. The primary disadvantage of the process is that hydrogen sulfide removal in excess of 93% is not practical with the process as it now stands. Also, the excess condensate from the inter-condenser and after-condenser must be stripped of the H2S and hydrogen cyanide gases before it can be dumped into the coke plant discharge sewers.

41530 **APTIC NO. 63796**

Kramer, W. Edward and Edward Mitchell

VAPOR RECOVERY SYSTEM. *(Gulf Research and Development Co., Pittsburgh, Pa.) U. S. Pat. 3,776,283. 6p., Dec. 4, 1973. 7 refs. (Appl. June 15, 1972, 6 claims).*

A vapor recovery system for recovery of volatile liquids displaced from tanks loaded from a tank truck is described. Gasoline vapors displaced from the tank are a source of unoxidized hydrocarbons discharged into the atmosphere. A canister containing an adsorbent material is detachably mounted on a tank truck for delivery of the gasoline. An inlet to the canister is connected through a vapor recovery hose to the vapor space in a liquid storage tank and an outlet to the canister is connected to the vapor space in a tank on the truck. As the volatile liquid is delivered into the storage tank, air displaced from the storage tank is forced via the vapor recovery hose through the adsorbent and into the delivery tank. Vapors of the liquid are adsorbed in the canister. Pressure relief means are connected to require all air entering or leaving the tank on the truck to pass through the canister. Earlier apparatus proved too bulky and expensive for use at individual service stations.

41531 **APTIC NO. 64242**

Krill, Helmut

THE SULFREEN PROCESS. *Institution of Chemical Engineers, London (England), Northwestern Branch and Salford Univ. (England), Proc. Int. Conf. Control Gaseous Sulphur Compd. Emiss., Salford, England, 1973, 15p. 17 refs. (April 10-12.)*

The removal of hydrogen sulfide and sulfur dioxide from Claus- kiln waste air with recovery of sulfur using the Sulfreen process is described. An adsorption catalyst of activated carbon and/or alumina is used. Activated carbon with greatly opened pore structures is preferred as the S formed by the H2S oxidation must be deposited in the pore volume of the activated carbon. The mechanical strength and chemical stability of the carbon is particularly important, as chemical stability must be sufficient to prevent grain destruction under increased temperatures. Due to the interaction between adsorption and desorption the process operates discontinuously. The reaction is slightly exothermic. When the catalyst of the reactors switched to adsorption has reached the S loading feasible according to different criteria these reactors are removed from adsorption and switched to regeneration. Regeneration is effected using a gas essentially consisting of nitrogen, comprising two process steps; heating and desorption, and cooling. The Sulfreen process enables the removal of H2S and SO2 according to 3 different methods providing efficiencies of 70 to 90%. The total efficiency of the process can be increased to 98.5-99.5%. Data on investment and operating costs are provided.

41532 **APTIC NO. 64000**

Kukin, Ira

EFFECT OF ADDITIVES ON BOILER CLEANLINESS AND PARTICULATE EMISSIONS. *Society of Engineering Science, Pollut. Eng. Sci. Solutions, Proc. Int. Meet. Soc. Eng. Sci., 1st, Tel Aviv, Israel, 1972, p. 105-121, 1973. 8 refs. (June 12-17.)*

Concentrated metal-containing additives are often used in oil-fired furnaces to improve boiler cleanliness and reduce corrosion of the firesides and air heaters. They can also reduce stack emissions, especially hydrocarbon particulates and sulfur trioxide. They can improve the handling characteristics of the ash in the flue gas in oil-fired boilers equipped with precipitators and stack collectors. Significant fuel additives in use today contain magnesium oxide, manganese, or magnesium oxide with manganese. The role of MgO as a fuel oil additive with high sulfur and high vanadium fuels is described. Low sulfur-low vanadium fuels often contain manganese additives. High temperature slagging and corrosion in oil-fired boilers is reduced with a slurry containing both MgO and Mn in combination. Manganese additives reduce internal boiler fouling of superheaters and reheaters at low ash input ratios. High sulfur fuels with low V content are preferably treated with tail end chemical injection of an active neutralizing agent to remove SO_3. Overall decrease in stack emission ideally is obtained with a dual additive application consisting of addition of Mn to the fuel oil and a neutralizing agent to the economizer outlet. Manganese additives eliminate stack smoke, particularly in refineries burning pitch or polymerized bottoms. Corrosion and fouling from SO_3 in coil-fired units can be eliminated by aspirating an activated neutralizing agent in powder form into the economizer outlet of the furnace. Other uses of additives are discussed.

41533 **APTIC NO. 64023**

Kusler, David J.

DEMAND FOR PLATINUM TO REDUCE POLLUTION FROM AUTOMOBILE EXHAUSTS. *Bureau of Mines Information Circ., no. 8565:1-36, 1973. 27 refs.*

The demand for platinum for use as a catalyst in the national abatement of automobile exhaust pollution was appraised. The Clean Air Act of 1970 as amended requires automobiles produced to control automobile exhaust emissions. The need for automobile pollution control, the methodology for such control, the annual primary (new) platinum demand for automobiles produced from 1975 to 1990, primary platinum availability, and supply-demand forecasts and outlook were considered. The new platinum demand for automobile exhaust converters, based on a converter service life of 50,000 mi, is estimated to be 1.4 million troy ounces initially in 1975, rising to 1.68 million in 1980, and declining curvilinearly to 0.94 million in 1990. The petroleum industry's demand for new platinum for the production of lead-free gasoline could total as high as 1 million troy ounces between 1972 and 1981, just for expansion of isomerization and reforming capacity, and is in addition to normal operating demand for this metal. (Author abstract modified)

41534 **APTIC NO. 64246**

Landrum, L. H.

THE CLEANAIR SULPHUR PROCESS. *Institution of Chemical Engineers, London (England), Northwestern Branch and Salford Univ. (England), Proc. Int. Conf. Control Gaseous Sulphur Compd. Emiss., Salford, England, 1973. 15p. (April 10-12.)*

The CLEANAIR Sulfur Process, used to remove sulfur constituents from Claus Kiln stack gas is described. It is installed immediately upstream of the incinerator in a conventional Claus system and may preclude the need for incineration. The Claus kiln effluent containing sulfur dioxide, hydrogen sulfide, carbonyl sulfide, carbon disulfide, and sulfur enters the CLEANAIR Process. The clean gas leaving the process is substantially free of sulfur constituents such that the overall recovery of H_2S entering the Claus kiln is in excess of 99.9%. The process consists of 3 stages which can be installed stepwise to achieve increasing cleanup of the Claus Kiln effluents down to 200 ppm SO_2. The Stretford process is integrated with the CLEANAIR. Only about 50% of the S in the tail gas is removed in Stretford and the cost of this portion of the plant is less than it would be were all of the S in the tail gas treated by Stretford. The CLEANAIR Process is designed to prevent emission under upset condition of the Claus kiln operation.

41535 **APTIC NO. 64044**

Lapedes, D. E., L. Forrest, F. G. Ghahremani, O. Hamberg, W. U. Roessler, W. M. Smalley, M. Hinton, T. Iura, and J. Meltzer

GAS TURBINE ENGINE PRODUCTION IMPLEMENTATION STUDY, VOLUME II: TECHNICAL DISCUSSION (FINAL REPORT). *Aerospace Corp., El Segundo, Calif., Urban Programs Div., Environmental Protection Agency Contract 68-01-0417, Work Unit OS314/R3531, Rept. Dept. of Transportation-TSC-OST-73-26-Vol. 2, ATR-73(7223)-1, Vol. II, 263p., July 1973. 87 refs.*

NTIS: PB-225 466

A summarization and assessment of available information pertaining to the potential for implementing mass production of gas turbine engine powered automobiles are presented including schedule requirement for that implementation. Emphasis was directed toward identifying those critical or limiting factors affecting timely introduction of gas turbine engine concepts on a mass production basis. A description of basic automotive product development phases, engine manufacturing processes, and gas turbine engine current technology status are included to clarify and augment the discussions, and to permit the necessary understanding of the developed implementation schedules. Based on data acquired Feb. 28 to April 30, 1973, a period of 8-10 yr is a best estimate of the elapsed time until 300,000 gas turbine engines are mass produced anually. The estimate is based on a postulated overall product development schedule of a slightly more than 11 yr. Three major issues need to be resolved: improvements in engine fuel economy and exhaust emissions; development of new mass production fabrication processes directed at reducing engine unit cost; and statistical evidence of engine durability in fleet test cars. (Author abstract modified)

41536 **APTIC NO. 64314**

Lavoie, George A. and Paul N. Blumberg

MEASUREMENTS OF NO EMISSIONS FROM A STRATIFIED CHARGE ENGINE: COMPARISON OF THEORY AND EXPERIMENT. *Combustion Sci. Technol., 8(1):25-37, 1973. 20 refs.*

Measurements of nitric oxide exhaust emissions were made on a single-cylinder engine with and without stratification. The results were compared with predictions based on an existing computer model of Blumberg. Combustion duration, a critical parameter of the model, was inferred from experimental pressure- time records for each condition studied. In premixed operation at low NO levels, the post-flame Zeldovich kinetics are used by Lavoie et al., could not account for the observed concentrations. The discrepancy was ascribed to flame-formed NO, and a correction to the kinetics was made based on the measurements of Fenimore. With this correction, good qualitative agreement between theory and experiment was obtained for the premixed case. On the basis of these results, the modified kinetics were also employed in the stratified charge calculations. For stratified operation, calculations were made with a number of assumed stratification functions, and the results were compared with experimental measurements. The best fit to the data was obtained for a strongly stratified fuel distribution with equivalence ratio variations from the mean on the order of the mean itself. Theory and experiment agreed to within a scale factor of approximately two. Further improvements in the absolute accuracy of the model would require consideration of heat transfer effects and a better estimate of flame-formed NO. The usefulness of stratification for NO control is highly dependent on the overall equivalence ratio. At equivalence ratios near stoichiometric and for equal exhaust gas recirculation rates, stratified charge operation gives lower NO concentrations than premixed operation. For mixtures leaner than equivalence ratio equal to 0.8, however, stratification results in a loss of NO control compared to the premixed case. (Author abstract)

41537 **APTIC NO. 63809**

Leas, Lawrence E., Robert E. Leas, and Cecil J. Johnson

PRODUCTION OF DESULFURIZED LIQUIDS AND GASES FROM COAL. *(Leas Brothers Development Corp., Columbia City, Ind.) U. S. Pat. 3,779,893. 6p., Dec. 18, 1973. 3 refs. (Appl. March 21, 1972, 6 claims).*

An integrated process for simultaneously recovering liquid and gaseous products from coal is presented. It also provides a means for desulfurizing the liquid and gaseous products recovered from coal prior to its consumption. A slurry is formed from crushed coal and recycled oil and is introduced to a three- zone reactor along with a hydro-cracking catalyst and sand, the latter of which acts as a conveying medium. In the first zone, coal liquids are extracted and conveyed to a fractionation unit. In the second zone, the carbon coked on the solids is gasified with air creating a producer gas which flows upwardly countercurrent to the downward flow of the mixture and supplying heat for the extraction stage. In the third stage, the remaining carbon is gasified with oxygen and carbon dioxide to a substantially nitrogen-free carbon monoxide. The carbon monoxide is desulfurized in a metal oxide bed. (Author abstract)

41538 **APTIC NO. 63774**

Lotze, Joerg and Wilhelm Jugel

CHARACTERIZATION OF TISSUES AS FILTER MEDIA WITH REGARD TO DUST SEPARATION. *(Charakterisierung des Filtermediums Gewebe im Hinblick auf die Staubabscheidung). Text in German. Wiss. Z. Tech. Hochsch. Chem. Carl Schlorlemmer Leuna-Merseburg, 15(3): 188-198, 1973. 19 refs.*

Different natural and synthetic fiber tissues as filter media for dust separation were analyzed by flow and geometric methods for their characterization with respect to dust separation. Tissues in which the flow occurs predominantly around the fibers can be characterized by the effective pore radius as determined by the pressure gradient method and a dimensionless parameter which takes differences in the flow characterictics of different tissues into account. The characterization of tissues in which the flow occurs predominantly through the fibers requires additional parameters such as the mean hydraulic fiber pore radius. Dust separation processes can not be characterized by purely geometrical magnitudes, such as the mean interyarn diameter or the mean interfiber distance in the yarn as determined from the tissue structure.

41539 **APTIC NO. 64064**

Margraf, Adolf

SULPHUR OR CHLORINE COMPOUNDS REMOVAL FROM DUSTY OR SMOKEY GAS. *(Verfahren zum Intfernen von Schwefel-oder Chlorverbindungen aus Staub-oder Rauchgasen). Text in German. (Heinrich Luehr VDI Staubtechnik Stadthagen) W. Ger. Pat. Appl. 2,215,065. 2p., Oct. 14, 1973. (1 claim).*

Sulfur or chlorine compounds are removed from dusty or smokey gases by addition of chemical compounds, e.g., oxides or hydroxides of alkaline, alkaline earth metals, or aluminum, in powder form or as a suspension of dusty gases at high temperature and removing the solid sulfur-or chlorine-compounds formed by filtration with chamber or tubular filters. The filtered out dust to filter approaches in amount 2-100 times dust per unit of time. The accumulated dust is withdrawn from the filter in amount corresponding to the rate of supply of dust in the gas to be purified and the dust gas is recycled.

41540 **APTIC NO. 64205**

Martin, Homer Z.

REMOVING SULFUR DIOXIDE FROM EXHAUST GASES. *(Abgasentschwefelung). Text in German. (Esso Research and Engineering Co., Linden, N. J.) W. Ger. Appl. 2,252,459. 24p., May 3, 1973. (7 claims).*

A support system for removing sulfur dioxide from exhaust gases at 300-400 C is prepared by treating a porous, extruded alumina support with copper nitrate solution and calcining. The efficiency of SO2 removal varied with the % copper impregnated in the support and the concentration gradient of Cu along the adsorption tube. Joe A. Vinson

41541 **APTIC NO. 63783**

Maruoka, Hiroyauki

VEHICULAR AIR-POLLUTION PREVENTIVE APPARATUS. *(Nissan Motor Co., Ltd., Yokohama (Japan)) U. S. Pat. 3,779,349. 11p., Dec. 18, 1973. 3 refs. (Appl. Sept. 12, 1972, 16 claims).*

To prevent emission of toxic compounds from an automotive engine during idling an apparatus is provided which includes one switch means responsive to a temperatue of the engine and another switch means responsive to an uncoupled condition of a power transmission system. These two switch means are connected to an ignition coil and de-energize the coil when the engine temperature is higher than a predetermined level and concurrently the transmission system is in an uncoupled condition. To solve vehicular air pollution problems in urban and highway traffic lines, it is highly preferable that the engines be shut down when the vehicle is brought to a full stop. This device accomplishes this, and starts the vehicle engine immediately before it is driven from rest. (Author abstract modified)

41542 **APTIC NO. 63802**

Maruoka, Hiroyuki

IGNITION TIMING CONTROL SYSTEM. *(Nissan Motor Co., Ltd., Yokohama (Japan)) U. S. Pat. 3,776,205. 8p., Dec. 4, 1973. 7 refs. (Appl. Jan 20, 1972, 3 claims).*

An improved and simple ignition and timing control system for use in an automotive spark ignition internal combustion engine adapted to reduce pollution emission is described. This system warms the engine faster, reducing unburned hydrocarbons in the exhaust gases during this period. The engine has a d.c. voltage source and throttle opening device connected to the voltage source for opening the carburetor throttle valve when it is energized. The throttle valve opening device is energized during neutral condition of the auto when the engine is cold. The system further includes a relay connected to the voltage source, an ignition coil connected to the relay, and a distributor including an advancing breaker point connected through the ignition coil to the relay and a retarding breaker point connected to the relay, whereby an electric current path from the voltage source through the relay to the retarding breaker point is established while the carburetor throttle valve is opened by the acutation of the throttle valve opening device effecting faster warm-up of the engine to prevent air pollution.

41543 **APTIC NO. 64355**

Matsushita, Masao

DUST COLLECTOR. *(Matsushita Dendokogu Co., Ltd., Osaka (Japan)) U. S. Pat. 3,778,978. 5p., Dec. 18, 1973. 8 refs. (Appl. Nov. 30, 1971, 1 claim).*

A dust collector is described comprising a closed water tank and a floating member for receiving dusty air and blowing it into water contained in a confined bowl-like depression formed in a base plate of the floating member to splash the water upward to a tray placed above the bowl. By rebounding repeatedly between the tray and bowl, water screens are formed around dusty air and catch dusts which settle at the bottom of the water tank. The collector does not use as much energy as collectors which pass dusty air through a zigzag path filled with water and has better dust collecting ability than collectors forcing dusty air through water screens. The invention is simple, the structure is robust having no damageable parts, and the maintenance cost is almost nonexistent. (Author abstract modified)

41544 **APTIC NO. 65963**

McCarthy, Daniel, Anthony Palmer, and Louis Theodore

SIMULATION OF A GRAVITY SETTLER--EFFECT OF VELOCITY, PARTICLE SIZE, AND PARTICLE MASS FLOW RATE DISTRIBUTION ON COLLECTION EFFICIENCY. *Louisville Univ., Ky., Speed Scientific School, Environ. Eng. Sci. Conf., Proc. 3rd Annu. Meet., Louisville, Ky., 1973, p. 715-733. 7 refs. (March 5-6.)*

The behavior of particles in a gravity settler was simulated to predict collection efficiency. A model for the prediction was developed, solved, and programmed for the digital computer. This is the first attempt to treat the effect of Reynolds numbers on particle drag, particle size distributions and variations in particle size distributions, partiel mass flow rate gradients, and variable bulk gas velocity profiles. The method of solution is based on the repetitive calculations of the describing equations with the magnitudes of the variables being determined by the assignment of random numbers. (Author abstract modified)

41545 **APTIC NO. 63474**

Mohanrao, C. J.

POLLUTION IN FERTILISER INDUSTRY. *Fertiliser News., 18(11): 7-13,16, Nov. 1973. 10 refs.*

The control of air pollutants from the fertilizer industry in India is discussed. The Indian Standards Institution is in the process of setting up air quality standards. The major pollutants are dust, sulfur and nitrogen oxides, fluorides, hydrogen sulfide, and ammonia. Commonly used dust control units include cyclone separator, wet scrubbers, bag filters, and electrostatic precipitators. The reduction of SOx in stack gas is accomplished by dry processes, wet processes, catalytic oxidation, and reduction. The NOx from the nitric acid and nitrophosphate plants are treated by absorption, adsorption, and catalytic reduction through the double combustion process or selective reaction process. The fluorine compounds are normally removed by wet scrubbing.

41546 **APTIC NO. 64255**

Moyes, A. J. and J. S. Wilkinson

THE DEVELOPMENT OF THE STRETFORD PROCESS. *Institution of Chemical Engineers, London (England), Northwestern Branch and Salford Univ. (England), Proc. Int. Conf. Control Gaseous Sulphur Compd. Emiss., Salford, England, 1973, 28p. 3 refs. (April 10-12.)*

The chemistry of the Stretford process is presented, along with notes on the history of hydrogen sulfide removal from manufactured fuel gas, inasmuch as it leads to this process. The first alkaline method to remove carbon dioxide and hydrogen sulfide from coal gas is reviewed. The ferric oxide process, in which the hydrogen sulfide was oxidized to elemental sulfur by a process whose chemistry was not unravelled during the 19th century, is described. Conditions following the second world war stimulated the need for gas washing processes to supplant the gas/solid reaction process for hydrogen sulfide removal. The first stage in the development of the Stretford process was a simulation of the solid process and the gas was washed by a suspension of iron oxide. The need to use true solutions in the washing process led first to Dr. Nicklin's ADA process which used a quinone redox cycle to oxidize hydrogen sulfide, albeit at the cost of producing excessive amounts of oxysulfur acids. The suppression of the water soluble oxysulfur acids required a chemical reaction which would almost instantaneously convert the hydrosulfide ion in an alkaline wash-liquor to elemental sulfur. In the Stretford process the two uppermost valency states of vanadium are exploited for this purpose. The plants that Holmes evolved to utilize the Stretford process and several of the major technical contributions that led to the process as used today are described.

41547 **APTIC NO. 63784**

Muhlrad, Wolf

ADSORPTION OF FLUORINE AND FLUORINE COMPOUNDS ON ALUMINA. *(Air Industrie, Courbevoie (France)) U. S. Pat. 3,780,497. 7p., Dec. 25, 1973. 3 refs. (Appl. Aug. 20, 1971, 10 claims).*

A method is provided for adsorbing fluorine on particles of alumina, the fluorine being in the elemental state or in the form of gasous fluorine compounds, and for collecting any ultra-fine dust resulting for example from sublimation. The fumes charge with fluorine compounds are one of the most unpleasant sources of atmospheric pollution, and their removal upon leaving electrolytic baths is necessary. The adsorption of the fluorine compounds on powdered alumina mitigates atmospheric pollution. The alumina particles are introduced at the base of an adsorption column through which the stream of gas to be scrubbed flows, the column terminating in a separator where the particles charged with fluorine are recovered. The path of the exhaust gas is cyclone separator to cloth-filter separator to scrubber. The method is particularly suitable for scrubbing of gas from electrolytic baths in an aluminum-producing plant.

41548 **APTIC NO. 63820**

Murakami, Taizo

DEVELOPMENT OF CYCLONE DUST COLLECTORS FOR COLLECTING SUBMICRON MICROPARTICLES. PART 1. *(Sabumikuronkyu no bifunjin o shushu suru saikuron shujinki no kaihatsu. Dai-1-po). Text in Japanese. Kinki Daigaku Kogai Kenkyusho, Kenkyu Hokoku (Kinki Univ. Pollut. Res. Inst. Rep.), no. 1:101-112, June 1973. 3 refs.*

A high-efficiency cyclone for the collection of submicron microparticles with 85-90% collection efficiency was developed. The performance of the cyclone was tested using air flow containing suspended microparticles of magnesium oxide, talc and calcium carbonate at room temperature under atmospheric pressure. The cyclone, with cylindrical body diameter of 150 mm, was designed for an inlet velocity of 70-80 m/sec. The schematic diagram and dimensions of the cyclone are given. The design factors, vortex in terms of the tangential velocity distribution and pressure distribution, pressure drop and collection efficiency are evaluated. The collection efficiency can be increased drastically by increasing the inlet velocity, thus increasing the tangential velocity of vortex and centrifugal force exerted on dust particles. As a result, the dust particles can be separated readily with high efficiency. The collection efficiency measured was 75.0-76.2% for MgO, 84.4-92.2% for talc and 50-53.4% for CaCO3. The anticipated efficiency was not attained except in the case of talc. The cause for the still unsatisfactory efficiency is a subject for future study.

41549 **APTIC NO. 64307**

Nigol, Olaf

SEPARATION AND REMOVAL OF SELECTED GAS COMPONENTS FROM GASEOUS MIXTURES. *(Assignee not given.) Brit. Pat. 1,340,195. 8p., Dec. 12, 1973. (Appl. June 22, 1971, 23 claims).*

A method and apparatus for the separation and removal of selected gas components from gaseous mixtures and particularly for the removal of sulfur dioxide from flue gases are described which utilize the property of electronegativity of certain gases. The gaseous mixture in which at least one component is an electronegative gas is passed as a stream between a pair of electrodes, viz., a cathode and an anode, ionizing a component of the mixture. An electric field is produced between the electrodes such that a flow of gas is induced towards a respective electrode. A chemically reactive surface is provided to intercept the flow and react with the selected gas component. The chemically reactive surface may be constituted by a film of chemically reactive liquid (e.g., sodium hydroxide or very dilute aqueous glacial acetic acid) flowing along the innter surface of the anode.

41550 **APTIC NO. 63760**

Nohira, Hidetaka and Masaru Kokokawa

EXHAUST EMISSION CONTROL DEVICE. *(Toyota Jidosha Kogyo Kabushiki Kaisha, Toyota City (Japan)) U. S. Pat. 3,779,014. 4p., Dec. 18, 1973. 6 refs. (Appl. Oct. 14, 1971, 3 claims).*

An exhaust emission control device for internal combustion engines is described. It comprises a hydrogen producing means, a control means for effecting control of the quantity of hydrogen produced in accord with the production of exhaust gases, and a hydrogen supply line for supplying hydrogen to an oxides of nitrogen reducing reaction chamber. This can reduce or remove NOx by a simple means without adversely affecting the performance of the engine. Previous control systems for NOx such as exhaust gas recirculation and ignition advance had the disadvantages that the recirculation gas line tended to corrode, difficulties occurred with carrying out the method, and the output of the engine was reduced. This new method has none of the disavantages of previous methods. (Author abstract modified)

41551 **APTIC NO. 64105**

Norgren, Carl T. and Robert D. Ingebo

EFFECT OF FUEL VAPOR CONCENTRATIONS ON COMBUSTOR EMISSIONS AND PERFORMANCE. *National Aeronautics and Space Administration, Cleveland, Ohio, Lewis Research Center, Work Unit 501-24, E-7336, 34p., June 1973. 11 refs.*

NTIS: NASA TM X-2800

The effects of fuel vaporization on the exhaust emission levels of nitrogen oxides, carbon monoxide, total hydrocarbons, and smoke number were obtained in an experimental turbojet combustor segment. Two different fuel injectors were used in which liquid ASTM A-1 jet fuel and vapor propane fuel were independently controlled to simulate varying degrees of vaporization. Tests were conducted over a range of inlet-air temperatures from 478 to 700 K, pressures from 4-20 atm, and combustor reference velocities from 15.3 to 27.4 m/sec. Converting from liquid to complete vapor fuel resulted in NOx reductions of as much as 22%, in CO and total hydrocarbons reductions of 36%, and reductions in smoke number up to 51%. Data are also presented on flame emissivity, flame temperature, and primary zone liner wall temperatures. Similar reductions in emission levels were observed with the second fuel nozzle geometry as the proportion of propane vapor was varied from 0-100%. Although substantial reductions in exhaust emission levels were experienced, the decrease was not as large as anticipated, probably because of inadequate control of the effective primary zone equivalence ratio. (Author abstract modified)

41552 **APTIC NO. 65770**

Oda, Hiroyuki

PURIFICATION METHOD FOR VENTILATED AIR. *(Hai kyuki joka sochi). Text in Japanese. (Sanyo Industries, Co. Ltd., Tokyo (Japan)) Japan. Pat. Sho 49-14755. 3p., April 12, 1973. (Appl. May 25, 1970, 1 claim).*

The invention is designed to improve the roof top ventilation system for factories and other types of large buildings. The ventilation system has a cover that is easily removable and on the top of purification pipes is a narrow shelf completely fitting the size of the ventilation pipe. The shelf has a removable block of activated carbon sheet woven into a lattice and has a handle. Since activated carbon filter devices have to be exchanged every three months or so, in a large factory with many ventilation pipes the exchange of filters can be quite time consuming. With thir improvement of a removable roof for the ventilater and a carbon block with a handle, the exchange operation can be very simple.

41553 **APTIC NO. 64259**

Oldenkamp, R. D. and C. G. Stegman

THE ATOMICS INTERNATIONAL MOLTEN CARBONATE PROCESS FOR SO2 REMOVAL FROM STACK GASES. *Institution of Chemical Engineers, London (England), Northwestern Branch and Salford Univ. (England), Proc. Int. Conf. Control Gaseous Sulphur Compd. Emiss., Salford, England, 1973. 28p. (April 10-12.)*

The molten carbonate process (MCP) for controlling power plant emissions is described in general and the pilot plant program in particular, with a status report on the latter. The MCP uses a molten eutectic mixture of lithium, sodium, and potassium to scrub the power plant gas stream. The sulfur oxides in the gas stream react with the molten carbonates to form sulfites and sulfates, which remain dissolved in an unreacted excess of carbonate melt. The molten carbonate (sulfite-sulfate) mixture is then regenerated chemically, converting the sulfite and sulfate back to carbonate and recovering the sulfur as hydrogen sulfide. The regenerated carbonate is recirculated to the scrubber to repeat the process cycle, and the hydrogen sulfide is converted to elemental sulfur in a Claus plant. The regeneration of the carbonate is done in two steps; first the sulfite and sulfate are reduced to sulfide, and then the sulfide is converted to carbonate plus hydrogen sulfide. The reduction is accomplished by reaction with a form of carbon, such as petroleum coke. The conversion of the sulfide to carbonate is accomplished by reacting with melt with steam and carbon dioxide. The test plan covers a one-year test program. The test period is divided up into four phases: Startup and Stabilization; Design Verification; System and Component Parametric Studies; and Reliability and Operability Studies.

41554 **APTIC NO. 65950**

Page, J. K.

ENERGY, ENVIRONMENT AND PLANNING. *Inst. of Fuel, London (England), Fuel Environ. Proc. Conf., Eastbourne, England, 1973, p. 157-165. 7 refs. (Nov. 26-29, Paper 14.)*

Problems of the fuel industry, including the mining, processing, distribution, and combustion of fuels, are reviewed from the standpoint of controlling the adverse environmental effects through planning control procedures. The importance of environmental models for planners is stressed along with the balancing of environmental costs against economic benefits. Procedures are schematically illustrated for the exploration and seeking of planning permission, the fuel-winning process with feedback checks against planning permission, the range of available control systems for atmospheric pollution from energy combustion systems, and techniques for pollution control by operational planning and legislative controls. Approaches reviewed for the control of gaseous and particulate urban air pollution include: fuel chemical content restrictions in particular areas, restriction of combustion techniques, emission standards in conjunction with stack height and location policies, and control of environmental spaces around combustion sources. The need for better meteorological analysis is stressed in relation to evaluating the pollution relationships between one area of a town and another.

41555 **APTIC NO. 64201**

Palma, Ted Vernon de

POLLUTION CONTROLLER FOR CARBURETOR COMBUSTION ENGINES. *(Einrichtung fuer Vergaser-Brennkraftmaschinen zur Verhinderung des Austritts von Kohlenwasserstoffen in die Atmosphaere). Text in German. (Universal Oil Products Co., Des Plaines, Ill.) W. Ger. Pat. Appl. 2,063,700. 4p., Oct. 11, 1973. 6 refs. (1 claim)*

A simple positive crankcase ventilation system combined with an air filter which recycles the lubricant vapors within the lubricant system, designed to prevent hydrocarbon vapor emissions from carburetor-type engines is described. The positive crankcase ventilation system has a housing which encloses a body formed from adsorption material for hydrocarbon vapors and which is connected at least one hydrocarbon emission source. The chamber is separated by the adsorption material from the clean air chamber of the intake filter. A channel system connects the fuel supply tank with the clean air region of the intake system. This chamber is connected to the crankcase via a line and has a distributor plate adjacent to the higher side of the adsorption body. The other side bounds a collector vessel for condensed lubrication oil, to which a return line leading to the crankcase is connected. The hydrocarbon vapors adsorbed during idle are desorbed from the adsorbent body at higher speeds.

41556 **APTIC NO. 63632**

Pandosh, J. P.

EVALUATION OF WPAF CERIUM COMPOUND ARL-56. *Sun Oil Co., Applied Research Dept., Proj. 13-106, Memorandum APD73-26, 6p., Dec. 20, 1973.*

A cerium compound, ARL-56, was tested as an antiknock compound for use in unleaded fuel. It should not poison noble metal catalysts in catalytic converters and is reported to be nontoxic. Tests were made on cars with an unleaded base fuel to determine octane benefits and exhaust emissions were measured in a 1973 noncatalyst car. The compound at 0.5-1 g/gal of cerium (6.23 g of compound) increased the road octane number of a clear fuel by about 1.5 numbers. There was little or no additional octane benefit in adding more than 1 g Ce/gal. The additive had no adverse effect on conventional exhaust emissions. The additive would be quite beneficial in the unleaded system even though its octane response is less than that of tetraethyl lead. This is provided that it does not poison catalysts or have any other adverse effects. Further octane and emissions testing is needed in more cars at lower levels (1 g/gal). If the same favorable results occur in a fleet of cars, durability testing should be undertaken. (Author abstract modified)

41557 **APTIC NO. 64354**

Parker, George, Sr.

METHOD AND APPARATUS FOR CONTROLLING AIR POLLUTION CAUSED BY VOLATILE EMISSIONS FROM STORAGE TANKS AND THE LIKE. *(Assignee not given.) U. S. Pat. 3,778,968. 7p., Dec. 18, 1973. 5 refs. (Appl. Aug. 10, 1972, 8 claims).*

A method and apparatus for controlling air pollution caused by volatile emissions from petroleum storage tanks and the like are described. The volatile emissions or vapors are passed through a brine or glycol solution having a controlled temoerature range for separating petroleum hydrocarbons, water, and air and for collecting the hydrocarbons so that they do not escape into the environment. This method is less expensive than air pollution control by floating roof construction or adsorption in carbon beds. Similar methods using brine lack temperature control, and therefore ice can form in the pipe and plug off the flow, thus exposing the system to an explosion as the pressures develop. This method does not have this problem. (Author abstract modified)

41558 **APTIC NO. 63689**

Puri, Balwant Rai, O. P. Mahajan, and S. S. Bhardwaj

INTERACTION OF SULPHUR DIOXIDE WITH ADSORBENT CARBONS. *Indian J. Chem., 11(11):1170-1173, Nov. 1973. 9 refs.*

The chemical interaction of sulfur dioxide and adsorbent carbons was studied at temperatures greater than 300 deg. It largely involved fixation of sulfur by the carbon, and to some extent, formation of free sulfur, sulfuric acid, and hydrogen sulfide through interaction with oxygen and hydrogen of the carbon. At the optimum temperature of 600 deg, almost the entire amount of sulfur dioxide mixed with nitrogen in the ratio of 1:3, 1:7, or 1:15 was eliminated in the same manner. Since most of the sulfur was fixed by carbon as a carbon-sulfur solid complex, the capacity of the carbon for the reaction depended on the concentration of the unsaturated sites present in the carbon. The results from this study can be used in improving the removal of sulfur dioxide from flue gas through chemisorption on carbons. The carbons tested included charcoals obtained by carbonization of recrystallized cane sugar and coconut shells, activated carbon black, and powdered soft coke. (Author abstract modified)

41559 **APTIC NO. 63690**

Puri, Balwant Rai, R. C. Bansal, and S. S. Bhardwaj

INTERACTION OF NITROGEN DIOXIDE WITH DIFFERENT CHARCOALS. *Indian J. Chem., 11(11):1168-1169, Nov. 1973. 10 refs.*

The interaction of nitrogen dioxide with charcoals at different temperatures was studied to understand the reaction mechanism and the optimum conditions for removal of the gas to combat air pollution. The passage of nitrogen dioxide mixed with nitrogen over charcoal, degassed at 750 or 1000 deg, involves appreciable reduction of the gas. A major portion of the oxygen rendered available is chemisorbed by the carbon while the rest of it causes combustion yielding free carbon dioxide. The optimum temperature for the reaction is 400 C. When NO_2 mixed with N_2 in the ratio of 1:15 is led at a flow rate of 1 l/hr over 5 g of charcoal in a bed, degassed at 1000 deg, and heated to 400 deg, nearly 90% of the gas is reduced and thus removed. The efficiency of the process depends not only on the surface area of charcoal, but even more on the concentration of unsaturated sites which alone are involved in the chemisorption of the oxygen. The carbon can be regenerated for reuse. (Author abstract modified)

41560 **APTIC NO. 64030**

Quigg, H. T.

REDUCTION OF POLLUTANTS FROM AIRCRAFT TURBINE BY FUEL SELECTION AND PREVAPORIZATION (FINAL REPORT). *Phillips Petroleum Co., Bartlesville, Okla., Naval Air Systems Command Contract N00140-72-C-6969, Rept. 6607-73, 184p., Oct. 1973. 20 refs.*

NTIS, DDC: AD-769 099

The effects of hydrocarbon type and fuel volatility on flame radiance and exhaust emissions were investigated using the Phillips 2 in. combustor, operated under conditions simulating those in modern aircraft turbine engines. A JP-6 fuel was used for reference and 10 pure hydrocarbons (normal paraffins, isoparaffins, cycloparaffins, and aromatics) with various boiling points within each hydrocarbon type were used. Empirical equations based on fuel and operating variables were developed for the prediction of flame radiance, nitric oxide, nitrogen oxides, carbon monoxide, and smoke. The inlet air temperature and humidity had the largest effects on NO_x emissions. Increasing the inlet air temperature increased NO_x and decreased CO emissions. Increasing the inlet air humidity decreased NO_x, but increased CO. The NO_x emissions can be adjusted to a standard ambient humidity using an equation independent of fuels and operating variables. The CO can also be adjusted using an equation independent of fuels and operating variables, other than inlet air temperature. Emissions of NO_x and CO are greater with pulverized fuel than with pressure atomized fuel. (Author summary modified)

41561 **APTIC NO. 64003**

Raben, I. A.

SULFUR DIOXIDE REMOVAL FROM GASES. U.S.: LIME-LIMESTONE. *Society of Engineering Science, Pollut. Eng. Sci. Solutions, Proc. Int. Meet. Soc. Eng. Sci., 1st, Tel Aviv, Israel, 1972, p. 192-214, 1973. 14 refs. (June 12-17.)*

The status of lime-limestone scrubbing for removal of sulfur dioxide from waste gases in the U. S. is reviewed. The chemistry involved, the main design problems, the status of pilot plant work, and the status of full-size installations are described. In the U. S., the most advanced SO2 removal process is lime-limestone scrubbing. This is a nonregenerative process, producing a throwaway product, calcium sulfate. This product is essentially insoluble, and therefore, does not contribute to water pollution. When properly dewatered, it can be used as landfill. Twenty-three full-size installations are operating or being engineered to provide important data for industry in the U. S. These installations are discussed. Several pilot plant studies are discussed including the Environmental Protection Agency s Alkali Scrubbing Test Facility.

41562 **APTIC NO. 64001**

Rigo, H. Gregor and James J. Stukel

HIGH TEMPERATURE DUST CONTROL--APPLICATION OF A COMBINATION PARTICLE COLLECTOR AND HEAT EXCHANGER. *Society of Engineering Science, Pollut. Eng. Sci. Solutions, Proc. Int. Meet. Soc. Eng. Sci., 1st, Tel Aviv, Israel, 1972, p. 122-132, 1973. 5 refs. (June 12-17.)*

High temperature convective heat exchange surfaces are damaged by dust erosion and their function is impaired by dust deposition. A novel heat exchange surface is presented which minimizes deposition on and erosion of boiler tube passes in fossil fuel-fired units. This is accomplished by removing particulate phases from an air stream. This will also enable boilers to meet Federal emission standards. A mathematical model is used to analyze this modified boiler tube. This demonstrably conservative predictor indicates that essentially all the material entrained in the gas stream entering a ten tube bank of the particulate precipitating heat transfer surface can be removed. Additional investigations are presented which demonstrate that there is no measurable difference between the heat transfer effectiveness of a conventional boiler tube and the flow separator and heat exchanger. On a new plant, the dust control apparatus results in an immediate cost savings; for an existing facility, the capital increase is offset by an operating cost decrease. (Author abstract modified)

41563 **APTIC NO. 64006**

Rigo, H. G., W. J. Mikucki, and M. L. Davis

CONTROL OF NITROGEN OXIDE EMISSIONS FOR NITRIC ACID PLANTS. *Society of Engineering Science, Pollut. Eng. Sci. Solutions, Proc. Int. Meet. Soc. Eng. Sci., 1st, Tel Aviv, Israel, 1972, p. 278-287, 1973. 10 refs. (June 12-17.)*

New Federal emission requirements limit nitrogen oxide emissions from nitric acid plants under normal operating conditions to 208 ppm. A brief description is given of the operation of a typical nitric acid plant and its control system. High pressure air is first mixed with pressurized, gaseous ammonia. The mixture is then passed over a platinum catalyst. An exothermic reaction occurs in the air-ammonia mixture which releases nitric oxide and water vapor. The hot gases are cooled in a heat exchange train. The NO oxidizes to nitrogen dioxide during the cooling step. Further temperature reduction occurs in a condenser and weak nitric acid results. The cooled gas goes to the bottom of a bubble tray column where the NO2 is absorbed in water to produce nitric acid. The weak acid removed in the condenser is injected into the tower where it absorbs more NO2 and becomes stronger. Overall, 50-65% HNO3 results. The tail gas contains 1500-3500 ppm NOx and 100% relative humidity. When the tail gas at the plant was tested, NO2 concentrations of 4500 ppm were found in the tail gas, indicating the plant was overdriven. Four NOx control techniques for the plant -- improved plant design, incineration, scrubbing, and selective catalytic reduction -- are reviewed briefly to establish their limitations. Two other approaches, general catalytic reduction and dry adsorption, are discussed in greater detail since they are most applicable to nitric acid plants. Life cycle cost-effectiveness analysis is necessary to determine the best control method. The NOx-specific molecular sieve is technically and economically the preferred control alternative. Although the initial capital cost of the adsorbing molecular sieve is almost twice that of catalytic reduction, the annual cost is approximately 1/2 that of methane-fueled catalytic reduction.

41564 **APTIC NO. 64213**

Rodin, Ervin Y.

ORBITAL POLLUTION CONTROL. *In: Pollution: Engineering and Scientific Solutions. Euval S. Barrekette (ed.), New York, Plenum, 1973, p. 38-53. 7 refs.*

A method is proposed to enhance the well known heat island effect over large cities. This effect causes warm air to circulate as a closed system, under a low inversion layer, over a city thereby causing the pollutants to remain essentially entrapped, with a constantly increasing concentration. It is suggested for the next 10-15 yr the application of additional heat content to a small portion of the interior of such a circulating regime might cause a chimney effect, with a resultant breakthrough in the inversion layer: followed either by a complete breakdown of this layer and the subsequent alleviation of heavy concentration doses by natural mixing; or by a ventilating of the city s airshed through the artificial chimney. It is further proposed that the additional heat necessary to generate this corrective measured should come from a source, the operation of which does not cause additional pollution and can be easily be utilized over continental expanses. Specifically, the end results of simplified calculations are presented which show that this problem may have a feasible solution by using a very large dirigible mirror, in stationary orbit. This mirror, since it is dirigible, could be directed at various cities during different hours of the day, and thus might represent an economically attractive proposition, for the attainment of this alleviative treatment. (Author abstract modified)

41565 **APTIC NO. 63813**

Roth, James F, James W. Gambell, and Charles R. Penquite

PROCESS OF TREATING AUTO EXHAUST WITH SHRINKAGE. *(Monsanto Co., St. Louis, Mo.) U. S. Pat. 3,781,406. 13p., Dec. 25, 1973. 13 refs. (Appl. July 7, 1971, 14 claims).*

Novel oxidation catalysts for removing carbon monoxide and hydrocarbons from the exhaust of automotive engines with a high conversion efficiency coupled with unusual resistance to volume shrinkage and weakening of the catalyst composite after exposure to high temperatures, are described. The catalyst couples good low temperature activity and high temperature stability with respect to volume shrinkage, activity maintenance, and strength preservation. The catalyst utilizes a transition alumina support and specified loadings of both copper and chromium to give the required activity, along with certain rate earths to control thermal volume shrinkage. The advantage over the prior are is in the presence of chromium in a specified concentration range and oxidation state. The chromium component is essential for imparting high activity.

41566 **APTIC NO. 64073**

Ryschka, Josef, Jirschi Frkal, Eduard Kolosch, Bretislav Panak, Lubomir Vagner, and Miroslav Pospischil

CATALYST SUPPORT FOR THE REMOVAL OF CARBON MONOXIDE FROM AUTOMOTIVE EXHAUST GASES. *(Katalysatortraeger, insbesondere fuer Einrichtungen zur Beseitigung von Kohlenmonoxyd aus den Auspuffgasen von Brennkraftmaschinen). Text in German. (Ostravsko-Karvinske doly oborove reditelstvi, Ostrava (Czechoslovakia)) W. Ger. Pat. Appl. 2,256,315. 18p., May 30, 1973. (5 claims).*

The passage of automotive exhaust gases through detoxicating filters for carbon monoxide removal was improved at increased catalyst surface area by 2.7 cm long cylindrical porous steatite catalyst supports of outside diameter 2.7 and wall thickness 1.3 mm. The supports were impregnated with manganese nitrate-copper nitrate solution and heated at 300C to give 0.001 mm thick catalyst coatings on the entire outer and inner surface area of the supports.

41567 **APTIC NO. 64156**

Sakanishi, Jun

SCRUBBER IN JAPAN CALLED HIGHLY SUCCESSFUL. *Elec. World, 180(10): 45-47, Nov. 15, 1973.*

The first 16 months of operation of a lime-additive, nonrecoverable sulfur dioxide scrubbing system at a Japanese power plant was highly successful. It is the first operational SO2 removal system larger than 100 Mw to achieve over 1 yr of continuous operation. It follows an electrostatic precipitator. Actual operating costs were less than the estimates of 1 mill/kwh. The system ran without shutdown and was free of defects, except for inspections and one boiler breakdown. Sulfur dioxide concentrates entering the scrubber average 1900 ppm at the inlet; emissions averaged 180 ppm, well below all Japanese national and local standards. Buildup and scaling were not a problem because of pH control combined with strategic use of required makeup water. The slurry from the closed-loop system was stored safely in a ponding operation without any of the secondary environmental ill effects associated with water pollution. The principal components of the unit were two nonadjustable venturi scrubbers with a capacity of 241,000 scfm each. Carbide sludge was used as the absorbent because it was readily available in the plant area at low cost. Considerable controversy emerged within the electric utility industry regarding the relevancy of this Japanese project to American-based power-plant applications because of differences associated with load cycling, fuel characteristics, and the chemical quality of sludge compared with U. S. lime materials.

41568 **APTIC NO. 64334**

Sasaki, Kazuo

AIR POLLUTION RESULTING FROM MOTOR CAR EXHAUST. *(Jidosha haishutsu gasu ni yoru taiki osen ni kansuru kenkyu). Text in Japanese. Kanagawa Daigaku Kogakubu Kenkyu Hokoku (Rep. Fac. Technol., Kanagawa Univ.), no. 11:76-83, March 1973. 2 refs.*

Experiments employing a muffler catalyst with respect to a gas mixture containing the following components, by volume, carbon monoxide, 4%; propane, 2%; oxygen, 10%; nitrogen, 84% approximately, for the purpose of eliminating carbon monoxide and propane from it are presented. In the performance test of commercial platinum catalyst, its catalytic power is excellent; 90% or more conversions of CO and C3H8 were simultaneously obtained at a temperature of 180 to 230 C or over and at the space velocity of 6000 to 18,000/hr. In the progress of two reactions of C3H8, the catalytic oxidation of CO precedes a free burning reaction of C3H8, which was provoked by the reaction heat then produced. In the pursuit of the component parts of Hopcalite (composed of manganese, copper, cobalt, and silver), simplification of components from quarternary to ternary or to binary, if possible, was attempted. With respect to a manganese-cobalt binary oxide catalyst, a composite of 50% Mn and 50% Co was employed. Conversions of CO and C3H8 at the temperature of 210 to 365 C were far lower than they were when the standard catalyst was employed. With respect to a manganese-copper binary oxide catalyst, two kinds of composite were employed, one containing 50% Mn and 50% Cu, the other 30% Mn and 70% Cu. The latter indicated an outstanding ability to eliminate CO and C3H8 with 90% or more conversion at the temperature of 200 to 300 C, while the former proved ineffective. A manganese-copper-cobalt catalyst (silver being removed from Hopcalite) had the best performance; 90% or more conversion was obtained at a temperature of 100-300 C and at the space velocity of 12,000 to approximately 18,000/hr. A performance test with a manganese-nickel-iron ternary oxide catalyst (a pseudo-hopcalite) was comparable to a Mn-Cu-Co catalyst.

41569 **APTIC NO. 63853**

Schauer, Wolfgang and Klaus Zeilinger

THE OPTIMUM PERFORMANCE GRAPH FOR THE LOW-POLLUTING OTTO ENGINE - A CONTRIBUTION TO THE DISCUSSION. *(Das optimale Kennfeld fuer den schadstoffarmen Ottomotor - ein Diskussionsbeitrag). Text in German. VDI (Ver. Deut. Ingr.) Z. (Duesseldorf), 6(34):1-36, Nov. 1973. 1 ref.*

A selection of the design parameters lambda and ignition time of a certain operating point so that the fuel consumption (be), the mean effective operating pressure (pe), and the emission of carbon monoxide, nitrogen oxides, and hydrocarbons are at an optimum is not feasible since the requirements for an accomplishment of this in part oppose each other. A compromise solution is provided which has the advantage that only the fuel consumption must be selected. Lambda and the ignition time can then be determined with the aid of measured curves so that NOx and HC reach a minimum concentration for the selected fuel consumption. The following procedure is necessary for this: First the functions be, pe, CO, NOx, and HC in dependence of lambda and the ignition time must be determined for every operating point. During this, the number of revolutions and the fuel volume must remain constant. Lambda is varied through changing the position of the throttle valve alpha (air throughput). Through this the optimum for be is at the same time also the optimum for pe. Next the additional supply for fuel which is acceptable is determined for every operating point. Since no major reduction of NOx and HC is achieved with an additional fuel consumption of more than 15 to 20%, this percentage should not be exceeded. The parameters lambda and ignition time which yield the lowest NOx level must be determined for the predetermined additional fuel consumption. For the obtained parameters lambda and ignition time, minimum hydrocarbon concentrations are obtained with very good approximation.

41570 **APTIC NO. 66029**

Schulenberg, Franz

AIR AS COOLING AGENT. *(Luft als Kuehlmittel). Text in German. Umwelt Aktuel., (6):45-68, 1973. 17 refs. (Presented at the conference held during Environment 72, Stuttgart, Germany, June 30-July 9, 1972.)*

The use of air as cooling agent in thermal power plants and industry is described with special regard to dry cooling towers. Economically, air cooling is superior to water cooling whenever the temperature difference between the two media exceeds 30 C. Dry cooling towers, based mostly on the direct cooling principle, have the advantage of saving cooling water and preventing fog formation and precipitation around power plants. The prevention of vapor emissions is also associated with the absence of salt emissions.

41571 **APTIC NO. 65861**

Schuster, E.

COMBUSTION OF SOLID, PASTY AND LIQUID CHEMICAL WASTE PRODUCTS AND THE WASTE GAS PROBLEM. *(Verbrennung fester, pastoeser und fluessiger chemischer Abfallstoffe und das Abgasproblem). Text in German. vVDI (Ver. Deut. Ingr.) Ber., no. 207:51-60, 1973.*

A process developed in a large chemical plant for the preparation and incineration of solid, pasty, and liquid wastes delivered in barrels is described. The caloric value of these wastes ranges from 0 to 13,000 kg/kcal, and some of these wastes are toxic. The specific type, toxicity, caloric value, and state of the chemical wastes to be incinerated is unknown. When these wastes were fed into the rotary furnace for incineration, soot formation was often observed due to air deficit as a result of the greatly varying caloric value. Therefore, the contents of the barrels are emptied into liquid nitrogen for homogenization prior to incineration, and the crushed, homogenized waste with largely uniform caloric value is fed into the rotary furnace. The dust content in the flue gases is separated by means of an electrostatic precipitator, after which hydrochloric acid is separated by means of water, in which process hydrochloric acid with 15-20% concentration is obtained. In a further separation stage, free chlorine, sulfur dioxide and nitrogen oxides are separated.

41572 **APTIC NO. 64249**

Scrase, T. A., D. W. Parry, and K. J. McKeown

A PROVEN NEW CONCEPT IN PACKING MEDIA FOR MASS TRANSFER OPERATIONS. *A BREAKTHROUGH IN GAS SCRUBBING. Institution of Chemical Engineers, London (England), Northwestern Branch and Salford Univ. (England), Proc. Int. Conf. Control Gaseous Sulphur Compd. Emiss., Salford, England, 1973, 20p. 3 refs. (April 10-12.)*

The development of a new range of tower packings for all gas/liquid and liquid/liquid contacting operations, called the Cascade (R) Mini ring is described. It is a dumped tower packing, manufactured in any metal and a variety of plastics. It provides a new range of packing sizes that produce lower pressure per loss unit of packing surface area for mass transfer, and also makes more effective use of this surface for mass transfer. The surface available in the Mini ring is not included in the dumped position as with Pall type rings, Saddles, and Raschig rings. This results in better performance per unit of geometric surface, better mixing of the liquid phase, and a reduction in channelling and fouling. Experimental results illustrate that Mini rings have considerably lower pressure drop characteristics with higher efficiency and capacity than any other tower packing of the Pall or saddle type, throughout a wide range of applications. The new packing is an economically viable proposition as a cost comparison shows, and as a consequence Mini rings are being used in a wide variety of applications, including acid gas absorption.

41573 **APTIC NO. 63801**

Simko, Aladar O.

ENGINE CONSTANT RATES EXHAUST GAS RECIRCULATION SYSTEM. *(Ford Motor Co., Dearborn, Mich.) U. S. Pat. 3,776,207. 4p., Dec. 4, 1973. 2 refs. (Appl. Nov. 3, 1972, 10 claims).*

An internal combustion engine is described, in which a constant rate of exhaust gas is recirculated back into the engine during at least portions of the complete engine operating cycle, reducing peak temperatures and consequently output of oxides of nitrogen. The invention directs all of the exhaust gases from a selected number of the engine cylinders to the air intake system of the engine for reburning in the engine proper, while the exhaust gases from the remaining cylinders are directed conventionally to the vehicle exhaust system. A diverter valve is included and operable in response to wide open throttle conditions to block the flow of exhaust gas into the engine air intake system while simultaneously directing all of the engine exhaust gases into the conventional exhaust system.

41574 **APTIC NO. 63539**

Smith, Warren M., Neville L. Cull, Lloyd A. Pine, and Dale D. Maness

REMOVING SULFUR DIOXIDE FROM EXHAUST GASES. *(Abgasentschwefelungsverfahren). Text in German. (Esso Research and Engineering Co., Linden, N. J.) W. Ger. Pat. Appl. 2,252,454. 37p., May 3, 1973. (16 claims).*

Sulfur dioxide is removed from exhaust gases by adsorption with a porous, extruded alumina support treated with an aliphatic alcohol, impregnated with copper nitrate and calcined to form active copper oxide. Reducing gases such as steam or carbon monoxide are used for regeneration.

41575 **APTIC NO. 66031**

Steimle, Fritz

WASTE HEAT REDUCTION AND WASTE HEAT UTILIZATION BY MEANS OF HEAT PUMPS. *(Abwaermeverringerung und Abwaermeverwertung mittels Waermepumpen). Text in German. Umwelt Aktuel., (6):97-113, 1973. 13 refs. (Presented at the conference held during Environment 72, Stuttgart, Germany, June 30-July 9, 1972.)*

The possibility of waste heat reduction and waste heat utilization by means of heat pumps is discussed with special regard to the use of heat pumps for domestic heating purposes. Heat pumps, operating on the refrigerator principle, use a cooling agent which takes up heat at low temperature while evaporating, after which this agent is brought to a higher temperature level by evaporation to release heat during the subsequent condensation. Heat pumps have the advantage of being able to utilize low-temperature heat and to release heat at higher temperature, with practically any source of waste heat being suitable. Heat pumps are most economically used for heat recovery from the exhaust air of air conditioning installations. Heat pumps can be successfully combined with electric heat-storage heaters as additional heat sources.

41576 **APTIC NO. 64349**

Steinberg, Meyer

A REVIEW OF NUCLEAR SOURCES OF NON-FOSSIL CHEMICAL FUELS. *Energy Sources, 1(1):17-29, 1973. 11 refs. (Presented at the American Chemical Society, Symposium on Non-Fossil Chemical Fuels, Boston, Mass., April 1972.)*

Energy from nuclear sources can be used in the form of high-energy radiation, thermal energy, or electrical energy. Each of these energy forms can be employed to produce nonfossil chemical fuels by transformation of available nonfossil substances. High-energy radiation from nuclear fission can be used either directly as fission-fragment energy in a chemonuclear reactor, or indirectly has neutron, gamma, and beta energy from isotopic sources. Fission-fragment energy is acutally the only radiation- energy source that can be generated in sufficient quantity and at low enough cost to be considered for production of fuels. The two basic fuels that can be generated are hydrogen from water and carbon monoxide from carbon dioxide. These can subsequently be converted to high-Btu gas or other liquid hydrocarbons. The main difficulties with fission-fragment chemonuclear systems are obtaining sufficiently high yields of fuel gases and demonstrating that a fuel essentially free of radioactive fission fragments can be produced. Thermal energy from nuclear fission as steam or as a high-temperature gas stream such as helium can be used to crack water to H2 and CO2 to CO. Carbon dioxide can be derived by thermal decomposition of limestone or by extraction from the atmosphere. However, temperatures are too high to allow safe operation of the nuclear reactor required for these processes with the materials of construction generally available. Nuclear thermal energy can be used to provide heat for coal gasification. Nuclear electrical energy can power electrolytic cells or electric discharges. In electrolytic cells, water can be decomposed to hydrogen and oxygen; then the H2 can be used as a primary fuel or be converted to a number of fuels. While the electric discharge can be used to decompose water and CO2, this process is usually less efficient than electrolysis. Reactive metals can be electrochemically produced and used as fuels. Borane and silane nonfossil fuels can be derived from H2, borax, and silica. If fusion energy replaces fission in the future, it can be used in a similar fashion to produce nonfossil chemical fuels. (Author abstract modified)

41577 **APTIC NO. 63606**

Stock, D. E. and C. T. Crowe

ANALYSIS OF THE FLOW FIELD IN ELECTROSTATIC PRECIPITATORS. *Preprint, Combustion Inst., 23p., 1973. 9 refs. (Presented at the Combustion Institute, Central States Section, Spring Meeting, Champaign, Ill., 1973.)*

The particle-gas flow field in a concentric electrostatic precipitator is analyzed using the tank-and-tube approach. The effect of particles on the gas flow field is determined. A comparison is made between collection efficiency predictions obtained from analysis of the flow field and application of the classical Deutsch equation. The overall collection efficiency is 88% with the computer solution, 91% with the Deutsch equation using an average field of 3 kv/cm, and 51% with the Deutsch equation using a field at the wall of 2 kv/cm. The particle loading in wire and tube electrostatic precipitators has negligible effect on the gas-flow field, and therefore, gas-particle momentum-coupling effects are unimportant. The computational scheme can be used to predict the performance of new precipitator designs as well as to assess the effect of changing operating variables on existing designs without relying on the empiricism underlying the Deutsch equation. (Author abstract modified)

41578 **APTIC NO. 64330**

Suga, K.

AIR POLLUTION CONTROL MEASURES TAKEN BY THERMAL GENERATING STATION. *(Karyoku hatsudensho no taiki osen boshi taisaku). Text in Japanese. Kankyo Joho Kagaku (Environ. Inf. Sci.), 2(4):64-71, Dec. 1973.*

Air pollution control measures taken by thermal generating stations include use of high quality fuel, dust collection facilities, and high stacks. In 1972, about 60% of the fuel in use was heavy oil. The average sulfur content of heavy oil used by 9 power companies in 1972 was 1%. In the case of the Tokyo Power Co. it was decreased from 2.7% in 1963 to 0.7% in 1972. The use of crude oil has been replacing that of heavy oil since 1963. Crude oil from Indonesia has less than 0.1% S content, but it must be kept at higher than 45 C to keep it fluid. The use of naphtha was introduced at the Kawasaki Thermal Plant of the Tokyo Power Co. in December 1972 since it is the next best fuel to liquefied natural gas. More LNG will be used by power plants although the cost of facilities is very high, and the process requires integration of production, transportation, and consumption. In order to enable use of heavy oil, crude oil, and naphtha at a single plant boilers and storage equipment must be modified. By 1975 efforts will be made to halve the S content. Both dry and wet desulfurization of stack smoke has been adopted. Examples include the activated charcoal method (Kashima Plant, Tokyo Power Co.), the activated oxidized manganese method (Yokkaichi Plant, Chubu Power Co.), the gypsum method (Amagasaki East Plant, Kansai Power Co.), and the Wellman-Lord process (Nagoya Plant, Chubu Power Co.). Although there is some doubt about the effectiveness of high stacks, it has been proved that the doubling of stack height reduces the ground concentration to 1/4 of its previous value. Efforts are being made to construct 200 m stacks and to concentrate them in one place. Efforts to suppress nitrogen oxides include two-stage combustion boilers, mixing of waste gas, a combination of these two methods, and the use of fuel with lower nitrogen content. Liquefied natural gas is dust free. Oil generates less dust than coal. The use of multicyclones and Cottrell dust collectors assures 97-98% dust collection efficiency. The use of ammonium decreases formation of acid smuts.

41579 **APTIC NO. 65961**

Swearingen, Thomas B. and Stanley P. Thompson

FULL SCALE TESTING OF A LOW LOSS PARTICULATE REMOVAL SYSTEM. *Louisville Univ., Ky., Speed Scientific School, Environ. Eng. Sci. Conf., Proc. 3rd Annu. Meet., Louisville, Ky., 1973, p. 685-697. 6 refs. (March 5-6.)*

A full scale prototype device to reduce particulate emissions from the discharge of an alfalfa dehydrator equipped for exhaust gas recirculation was tested. The gas stream particulates are used as condensation nuclei thereby increasing their mass and consequently permitting more complete removal by a centrifugal separator. The Static Regain Chamber, when operated with exhaust gas recirculation, leads to a substantial reduction in particulate emissions to well with allowable limits. Without water spray there was an average reduction of 30% in the particulate emission rate. With controlled water spray the particulate removal rate increased to 62% with an increase in system pressure loss of only 0.73 in. of water. (Author abstract modified)

41580 **APTIC NO. 63781**

Tagawa, Katsuhiro and Takuzo Kurosawa

AIR-POLLUTION PREVENTIVE SYSTEM. *(Nissan Motor Co., Ltd., Yokohama (Japan)) U. S. Pat. 3,779,224. 5p., Dec. 18, 1973. 7 refs. (Appl. March 1, 1972, 5 claims).*

An air-pollution preventive system for a gasoline-powered internal combustion engine adapted to eliminate the evaporaton of gasoline vapors from the fuel tank to the atmosphere is described. The gasoline vapors emitted from the fuel tank are introduced through a passage to the crankcase and admitted through the carburetor to the engine combustion chamber together with blow-by-blow gases in the crankcase. The flow of gasoline vapors into the crankcase is controlled by a pair of check valves adapted to be responsive to pulsations of the pressure in the crankcase caused by the reciprocating motion of the piston. An additional valve is provided in the passage leading from the fuel tank to the crankcase and is adapted to be automatically closed to block the passage upon opening of a closure member of a filler vessel for fuel replenishing purposes. The valve cooperates with an air escape pipe to prevent the fuel tank from being filled to its full capacity without leaving any unoccupied space for thermal expansion of the content. (Author abstract)

41581 **APTIC NO. 65807**

Tager, S. A., A. M. Kalmaru, N. I. Kuznetsov, B. I. Kruglov, and Y. P. Bulkin

THE FORMATION OF NITROGEN OXIDES IN THE TGMP-324 GAS/OIL FIRED BOILER. *Teploenergetika, 20(1):34-37, Oct. 1973. 5 refs.*

The formation of nitrogen oxides was studied during oil combustion in the open furnace chamber of a TGMP-324 gastight boiler of a 300 MW unit with multi-tier vortex burners. The effects of boiler load, excess air, and exhaust gas recirculation were studied. Different systems of supplying recirculation gases to the furnace were used. The existing system of supplying recirculating gases was rational and reduced nitrogen dioxide by 25%. At rated load, excess air of 1.05 and recirculation of 15% of the NO2 exhaust caused 0.6 g/cu m NO2, 1/3 less than in the PK-41 boiler with MO TsKTI cyclones and vortex burners. With no recirculation, 1.10 or more air, and 100% load, maximum NO2 would be 1.0 g/cu m. (Author summary modified)

41582 **APTIC NO. 63823**

Takahashi, Toru, Teikichi Komukai, Mikio Kondo, Toshiki Hasebe, Tadashi Noto, and Shuhei Takeda

A TRIAL METHOD OF REDUCTION OF NOX CONCENTRATION IN THE ENGINE EXHAUST GAS. *(Haiki gasuchu no NOx keigen e no ichi kokoromi). Text in Japanese. Hokkaido Jidosha Tanki Daigaku Kenkyu Kiyo (Bull. Hokkaido Junior Coll. Automob. Technol.), no. 3:23-28, April 1973. 5 refs.*

There are two approaches to the reduction of automotive exhaust emission: internal reduction and after-treatment. A preliminary experiment for the possible development of a reduction method for nitrogen oxides by after-treatment based on the solubility of NO2 in water was conducted. The exhaust gas from a 4-cycle diesel engine consisting mostly of nitric oxide was oxidized to nitrogen dioxide by adding air, and subjected to absorption by water. The NO2 concentration decreased linearly with time, exhibiting sufficient reduction effect in NO2 concentration. Using a sampling bag, the NO2 concentration was decreased greatly in the first 60 sec, and remained almost unchanged after this period. The absorbing capacity of water was tested by using the same water repeatedly, which showed a linear decrease in absorbing capacity with the times of use. The change in composition of sample gas with time due to the use of a sampling bag was investigated by measuring NO2 concentration. The NO2 concentration increased gradually in the first 40 min and remained stable after 40 min.

41583 **APTIC NO. 63795**

Tatum, David

PROCESS FOR DESULFURIZING FUEL. *(Assignee not given.) U. S. Pat. 3,779,722. 7p., Dec. 18, 1973. 5 refs. (Appl. Feb. 23, 1972, 6 claims).*

A process for testing liquid or solid fossil fuel to remove deleterious noncarbonaceous compounds and constituents, and more particularly sulfur, sulfides, organically bound sulfur, sulfur or protein origin, pyrites, and inorganic compounds, is described. This process improves fuel for use in metallurgical processing, for use in energy release by oxidation without pollution, and for economic gasification. The invention provides an intensive phase process improving quality and efficiency over previously used extended phase and other processes. This process includes producing spaced vortices of molten metal and passing the fuel with hydrogen donor material and a flux material through the spaced vortices to provide an interaction there-between. (Author abstract modified)

41584 **APTIC NO. 64070**

Teller, Aaron Joseph

FILTER AND METHOD FOR LOWERING ACIDIC GAS DISCHARGE IN EXHAUST PROCESS GAS. *(Verfahren und Filtervorrichtung zum Senken von Saeuregasausstroemungen in einem ausstroemenden Prozessgas). Text in German. (Teller Environmental Systems, Inc., New York) W. Ger. Pat. Appl. 2,251,031. 15p., May 10, 1973. (30 claims).*

Hydrogen fluoride, hydrogen chloride, and chloride are removed from industrial spent gases from glass making and aluminum producing processes by passage through sieves of finely divided nephelite syenite ore or alumina activated with sodium hydroxide or sodium carbonate. The adsorbents are blown as a finely dispersed powder or sprayed in aqueous suspension onto a sacking cloth filter 11.15 sq m to a depth of 1.27 mm. The acidic gases may be passed through a similar bed of adsorbent. The process may be continuous or carried out batch-wise.

41585 **APTIC NO. 63575**

Trempu, Rene and Jean-Pierre Gayda

RECOVERY OF SULFUR OXIDES AND IRON OR IRON OXIDES FROM IRON SULFATE SOLUTIONS OBTAINED IN THE DESULFURIZATION OF GASES. *(Verfahren zur Behandlung von Eisensulfaten). Text in French. (Compagnie Industrielle des Telecommunications Cit-Alcatel, Paris (France)) W. Ger. Pat. Appl. 2,231,200. 8p., Jan. 11, 1973. (5 claims).*

A chemical process for the recovery of sulfur dioxide and bivalent and trivalent iron and iron oxides from sludges obtained by dehydration of wash liquids used for the adsorption of SO2 and other gases from the flue gases is described. The sulfates present in the sludge are heated to 600-1100 C, and preferably 900-1050 C in the presence of carbon, and under exclusion of air. Relative to the sulfates, the ratio of carbon amounts to over 5% by weight, and for the recovery of magnetite, carbon is added at a rate of 5-7%, and preferably 5.5-6.5%. For the recovery of iron, 15% carbon is added. The SO2, generated at a rate of up to 55% in the gases, is used for sulfuric acid production.

41586 **APTIC NO. 64357**

Vancini, Carlo A.

GAS DRYING APPARATUS. *(Peabody Engineering Corp., New York) U. S. Pat. 3,778,980. 6p., Dec. 18, 1973. 21 refs. (Appl. July 12, 1971, 4 claims).*

An apparatus is described for removing suspended particulate matter from gases. It includes a transverse baffle plate having openings for the passage of gases and separating units in the openings including a central pipe through which the gases pass. It has vanes to cause rotation of the gas stream for the centrifugal separation of the suspended particles. A cap registers with the pipe having a central opening through which cleaned gases pass and has a deflecting annular rim with a depending skirt for deflecting the gases with a reversal in direction around the outside of the pipe to remove suspended particles by impingement. The apparatuses can be used to wash and dry gases to eliminate moisture an/ particulates. (Author abstract modified)

41587 **APTIC NO. 64250**

Vejvoda, Josef

COMPARISON OF THE ACTUAL FLUE GAS DESULPHURISATION IN THE 40 T/H BOILER SKODA USING A DRY LIMESTONE TECHNOLOGY WITH A MATHEMATICAL MODEL OF THE PROCESS. *Institution of Chemical Engineers, London (England), Northwestern Branch and Salford Univ. (England), Proc. Int. Conf. Control Gaseous Sulphur Compd. Emiss., Salford, England, 1973, 4p. (April 10-12.)*

Investigations were made with a full-scale oil-fired 40 tons/hr boiler SKODA, using a dry limestone technology, with a mathematical model of the process, in order to observe some properties of calcinates after their conversion in the boiler and to eliminate the calcium oxide fly ash reaction. To avoid unprofitable experiments and to create conditions for applying the results to other types of boilers, either of similar or larger capacities, a mathematical model was worked out of the boiler as a reactor for the reaction of calcium carbonate (CaO) with sulfur dioxide on the basis of the knowledge of both the flue gas velocities and temperatures in the boiler and the reaction kinetics of the process. The calculated values of desulfurization approximate the values found in the boiler within the second simulated stage. Results of the first stage could not be simulated since no temperature and velocity characteristics of flue gases were available. With the diminishing particle size the CaO conversion to calcium sulfate increases owing to both the quicker particle heating and higher reactivity.

41588 **APTIC NO. 64254**

Villa, Sergio

THE GIAMMARCO-VETROCOKE PROCESS FOR GAS DESULFURIZATION. *Institution of Chemical Engineers, London (England), Northwestern Branch and Salford Univ. (England), Proc. Int. Conf. Control Gaseous Sulphur Compd. Emiss., Salford, England, 1973, 19p. (April 10-12.)*

The Giammarco-Vetrocoke process, used in hydrogen sulfide selective absorption, is described. It was first applied to coke oven gas being used for ammonia production. The process is widely used in the purification of gas produced by the partial combustion of naphtha and natural gas under pressure for the production of ammonia or methanol. It has other applications for waste air from viscose plants, as well as for high pressure natural gas purification. The only restriction in using the process is due to the capacity of H2S to be handled, this being common to all oxidizing processes. The plants for viscose air purification are a direct example of control of gaseous sulfur compound emissions. The process solution is composed of alkaline arsenite and arsenate (sodium or potassium). The essential feature of the process is the absorption of all traces of H2S. The process will be used in future for control of waste gases, but due to the fact that it makes use of an arsenical solution, its application is met with reticence. This is basically unjustifiable, because it is easy to take the steps necessary to avoid any possible complications.

41589 **APTIC NO. 63815**

Wagner, William R.

NON-POLLUTING STEAM GENERATOR SYSTEM. *(Rockwell International Corp., El Segundo, Calif.) U. S. Pat. 3,779,212. 5p., Dec. 18, 1973. 5 refs. (Appl. May 12, 1972, 9 claims).*

A steam generating system is described comprising burning fuel which contains no sulfur or nitrogen in an atmosphere of pure oxygen to heat water in a heat exchanger for converting water to steam. Preferably, the fuel and oxygen are provided in liquid or gaseous form and are supplied under pressure to the combustion chamber, to provide more rapid combustion. Additional oxygen may be added to the burning gases as they are passed to the heat exchanger to further increase the temperature of the flame. Also, the water to be converted into steam is maintained isolated from the products of combustion. This generator provides a pollution-free device with full efficiency, avoiding turbine corrosion and foreign gas condensation or disposal. It requires little or no maintenance, is extremely compact, and is compatible with conventional electrical generating systems and, hence, can be retrofit into existing systems with burned out or obsolete boilers. (Author abstract modified)

41590 **APTIC NO. 64035**

Weaving, John Harold and Cecil David Haynes

ATMOSPHERIC POLLUTION CONTROL ARRANGEMENT FOR INTERNAL COMBUSTION ENGINE. *(British Leyland Motor Corp., Ltd., London (England)) Brit. Pat. 1,321,452. 8p., June 27, 1973. (Appl. Feb. 19, 1970, 7 claims).*

An engine modification for the control of nitrogen oxides in internal combustion engines is described. Unlike the results from other modifications, fuel consumption is not increased nor is the carburetor in a spark ignition engine contaminated. In this modification, an internal combustion engine consists of at least one cylinder having an inlet valve arranged to close after bottom dead center following the induction stroke of the engine, and an exhaust valve is arranged to open before bottom dead center during the power stroke of the engine. There is an additional valve connected to the cylinder through which the exhaust gases pass. This valve is open during the power stroke of the engine before the exhaust valve opens and when the pressure in the cylinder is at least one atmosphere greater than atmospheric pressure whereby gaseous products of combustion will be removed through the additional valve. The valve is arranged to re-introduce under pressure the gaseous products of combustion previously removed through the additional valve into cylinder or another cylinder substantially at the time the inlet valve closes, or shortly after closure of the inlet valve, whereby a lower combustion temperature will be obtained, thereby reducing the quantity of oxides of nitrogen in the gaseous products of combustion.

41591 **APTIC NO. 63712**

Wen, C. Y., C. T. Li, S. H. Tscheng, and W. S. O Brien

COMPARISON OF ALTERNATE COAL-GASTRIFICATION PROCESSES FOR PIPELINE-GAS PRODUCTION. *Energy Sources, 1(1):31-71, 1973. 34 refs.*

Various coal-gasification processes for pipeline-gas production are reviewed to select those processes which offer some future possibility and attractiveness for commercial development. The gasification processes are mathematically simulated and evaluated, using a methodology of system analyses which optimizes the operating and design criteria of each process alternative with regard to lowest cost or highest energy- utilization efficiency. In using systems methodology, a generalized method of economic comparison is established and problems of fundamental importance are identified. This study specifies those steps having significant effect so that a more precise and detailed evaluation can be made of the critical problem areas. The study also indicates areas of serious deficiency in the present-day technical knowledge needed to develop successfully the proposed coal-conversion process. The results are interpreted in terms of the most advantageous reaction path to follow for the coals having specific compositions and chemical characteristics, computing the capital and operating costs of the total coal-conversion plants and of the individual sections of the plant including the necessary benefit/cost relationships of modifications in the process scheme. (Author abstract)

41592 **APTIC NO. 63785**

Wenner, John G.

SULFUR OXIDES REMOVAL SYSTEM. *(Universal Oil Products Co., Des Plaines, Ill.) U. S. Pat. 3,780,498. 7p., Dec. 25, 1973. 4 refs. (Appl. March 31, 1972, 8 claims).*

This invention provides a continuous method for simultaneously effecting the adsorption of sulfur oxides from a waste stream and the desorption of retained oxides. It consists of maintaining the continuous rotation of a gas permeable cylinder-form bed of sulfur dioxide adsorbent material that has been divided into segmental zones by gas barriers means, passing the waste gas stream continuously into contact with at least one segmental zone of the bed, and recovering from an opposing side of such zone a gas stream with reduced content of sulfur oxides. At the same time a desorbing gas stream passes through at least one segmental zone which had adsorbed sulfur oxides on the material removing it substantially, and continuing the rotation of the bed through the waste gas and desorbing streams to effect a continuing desulfurization operation. The invention provides a continuous rotating bed system which can obviate the need of a swing bed operation to effect periodic regeneration of the SO2 adsorbing material. In the rotating bed system, two stages of rotating beds are used and rotated from a common axial power source, with a first contacted rotating unit serving as a heat exchanger zone to partially cool or regulate the temperature of the flue gas stream passing along to a second stage sulfur oxides removal zone.

41593 **APTIC NO. 63552**

Whitmyer, Alan

EVALUATION OF THE RETRONOX CLEAN AIR SYSTEM. *Environmental Protection Agency, Washington, D. C., Emission Control Technology, Div., Rept. 74-18-AW, 6p., Nov. 1973.*

The evaluation of the Retronox Clean Air exhaust gas recirculation System with a delayed spark advance is described. The spark advance is controlled with a vacuum delay valve between the carburetor and distributor. A modified PCV valve, giving increased flow through the PCV line, is used to give overall enleanment of the fuel air mixture. There was significant emission control of two of the three vehicles tested. The third vehicle installation, while demonstrating reduced carbon monoxide and nitrogen oxides levels, was characterized by increased hydrocarbon emissions. This increase in hydrocarbon may be due to lean misfire as the baseline vehicle was operating quite lean. Fuel economy changes due to device installation were not consistent or significant. An installation problem was encountered on the 1970 Chevrolet which pointed up the need, with this system, for careful attention by the installer. Even when the installation was corrected, the high hydrocarbon emission data suggest that final carburetor checks or adjustments might be beneficial. (Author conclusions modified)

41594 **APTIC NO. 63827**

Wilson, Wallace C.

METHOD AND APPARATUS FOR ELIMINATING SMOKE EMISSIONS FROM INCINERATORS. *(Assignee not given.) U. S. Pat. 3,776,151. 5p., Dec. 4, 1973. 5 refs. (Appl. Feb. 28, 1972, 4 claims).*

An apparatus for eliminating smoke emissions from incinerators burning paper is described. Emissions are eliminated by admitting cool air into a stack arranged to receive smoke from a combustion chamber for inducing a draft in the stack which opposes a natural draft therein. Smoke is carried along by the induced draft and returned to the combustion chamber, so that only gases free of particulate matter are emitted from the stack. The induced draft returning to the ocmbustion chamber as an overfire air has sufficient pressure for creating turbulence in the combustion chamber for retaining the smoke in the combustion chamber for a time sufficient to ensure its complete combustion. The cool air is admitted into the stack by a louvered portion provided in the stack and arranged adjacent the combustion chamber, and, alternatively, one or more louvered elements connected to the combustion chamber and the stack so as to be in parallel with the louvered portion. Ducts are connected to the louvered portion and louvered elements to reutrn smoke to the combustion chamber. Past attempts have been made to recycle the particulate matter to the combustion chamber by running a duct from the stack to the middle or lower portion of the chamber so as to employ the draft created in the chamber to draw the matter through the duct and chamber to the stack. (Author abstract modified)

41595 **APTIC NO. 65959**

Wisely, F. E. and H. B. Hinchman

REFUSE AS A SUPPLEMENTARY FUEL. *Louisville Univ., Ky., Speed Scientific School, Environ. Eng. Sci. Conf., Proc. 3rd Annu. Meet., Louisville, Ky., 1973, p. 457-470. (March 5-6.)*

The use of municipal solid waste as fuel for the direct production of electric power is discussed. Burning refuse in an existing power plant boiler assists in controlling air pollution where the alternate means of disposal would be incineration. Sulfur in refuse is low, while the chlorine content is considerably higher in refuse than in washed coals, but of the same order of magnitude as that in run-of-mine coals. A comparison of ash analyses for refuse and coal is illustrated. The ash is high in silica and significant differences are indicated in ferric oxide, aluminum, lime, and sodium oxide. There are no data available on the air pollution effects of the burning of refuse.

41596 **APTIC NO. 63953**

Yosim, Samuel J., Leroy F. Grantham, and Donald A. Huber

NON-POLLUTING DISPOSAL OF EXPLOSIVES AND PROPELLANTS. *(Rockwell International Corp., El Segundo, Calif.) U. S. Pat. 3,778,320. 5p. Dec. 11, 1973. 3 refs. (Appl. June 20, 1972, 14 claims).*

This invention provides a simple, rapid, non-detonating practical process for the disposal of explosives and propellants resulting in substantially reduced emission of environmental pollutants such as sulfur dioxide, hydrogen chloride, and nitrogen dioxide. Unwanted explosives and propellants are destroyed in a safe non-polluting manner by being contacted with a hot molten salt containing as essential reactive component alkali metal carbonate or hydroxide or mixtures thereof for pyrolysis and oxidation. Some of the resulting decomposition products that would ordinarily be released as atmospheric pollutants react with or are retained in the melt. Any combustible matter present in the melt may be further reacted by the use of oxidative molten salts alone or in combination with oxygen added to the melt. Formed gaseous products may be treated in a second reaction zone to complete oxidation of any combustible matter present before discharge of the gases to the atmosphere. The reactive component of the treated melt may be regenerated, or the melt may be disposed of, preferably by reaction with lime in an aqueous or molten medium to form a water-insoluble calcium salt residue. Particularly effective and preferred reactive molten salts are the sodium hydroxide-potassium hydroxide and lithium carbonate-sodium carbonate-potassium carbonate eutectic mixtures. The process offers a combination of advantageous features not previously available in a single technique, thereby allowing for the practical disposal of a wide variety of low or high explosive compounds, solids or liquids, and whether in particulate or lump form, in a safe non-polluting manner. (Author abstract modified)

41597 **APTIC NO. 63550**

National Industrial Pollution Control Council, General Manufacturing Sub-Council

THE TEXTILE INDUSTRY AND POLLUTION CONTROL. *23p., Feb. 1973. 1 ref.*

GPO

There is a great diversification of processes in the textile industry. Therefore, pollution abatement has been more of an individual company effort than it has an industry-wide cooperative program. While some plants have found it necessary to construct extensive waste water treatment systems and to buy elaborate equipment to prevent atmospheric contamination, others have had no problem at all. The progress that has been made in the pollution abatement programs conducted by the textile industry is summarized. Water and air pollution sources and control are reviewed. About 264 million tons of pollutants are discharged into the atmosphere; 54.5% due to transportation, 17% from fuel combustion in stationary sources, 14% from industrial processes, 4% from solid waste disposal, and the rest from miscellaneous sources. The pollutants include 55.8% hydrocarbons, and 9.6% nitrogen oxides. Air pollution control methods include electrostatic precipitators, wet scrubbers, fabric filters, and afterburners. (Author summary modified)

41598 **APTIC NO. 64032**

Horner and Shifrin, Inc., St. Louis, Mo.

SOLID WASTE AS FUEL FOR POWER PLANTS (FINAL REPORT). *Environmental Protection Agency Grant GO6-00176, EPA-SW-36D-73, 159p., 1973. 8 refs.*

NTIS: PB-220 316

The technical and economic feasibility of burning prepared municipal refuse as a supplementary fuel in large suspension-fired utility boilers was investigated, including methods of air pollution control. The best boilers are equipped with electrostatic precipitators. The substitution of prepared refuse for a small percentage of pulverized coal may result in an increase in the dust loading, but is not expected to result in a discernible difference in the function of the precipitators, nor in the general quality of the dust collected by them. Particulate emissions from the chimneys should not be increased by application of the proposed process. The sulfur content of refuse is small, far less than the S present in even high grade coal, and probably some decrease in sulfur oxides emissions would result in substituting part of the refuse for coal. The air pollution control regulations in effect in the St. Louis area require the use of low sulfur coal (approximately 1.4% maximum S) by March 24, 1970. The use of low S coal will increase utility fuel costs, and it is possible that the use of prepared refuse as supplementary fuel could minimize fuel costs.

41599 **APTIC NO. 64066**

(Inventor not given.)

EXHAUST GAS PURIFICATION DEVICE FOR INTERNAL COMBUSTION ENGINES. *(Toyota Jidosha Kogyo Kabushiki Kaisha, Aichi Prefecture (Japan)) Brit. Pat. 1,340,738. 4p., Dec. 12, 1973. (Appl. June 1, 1971, 6 claims).*

An automotive exhaust gas purification device of the oxidation manifold reactor type is described which, unlike prior art manifold reactors, presents newly introduced exhaust gas containing unburned gases from mixing with exhaust gas that has already undergone a reaction, thus permitting effective utilization of the limited space in the reaction chamber. The device consists of a cylindrical heat insulated casing closed at its ends, a cylindrical tubular radiation shield open at both ends inside and radically spaced from the casing, a cylindrical reaction chamber inside and radially spaced from the radiation shield, several exhaust gas inlet tubes entering the device and passing through the casing and radiation shield and connected to the reaction chamber, an exhaust gas outlet communicating with the space between the casing and the radiation shield, and a means to supply air under pressure to the exhaust gas inlet tubes. The mixtures of exhaust gas and air enter the reaction chamber tangentially and rotate therein, unburned gases and other noxious matter being oxidized while the mixture is rotating. The gases move inwardly towards the axis of the reaction chamber and leave through the central openings to pass into the space between the casing and the radiation shield and into the exhaust gas outlet.

41600 **APTIC NO. 64206**

(Inventor not given.)

REMOVAL OF MERCURY FROM GASES. *(Verfahren zum Reinigen von gasen von mitfefuerten Quecksihberverunreinigungen). Text in German. (Det Norske Zinkkompani A/S, Eitrheim, Odda (Norway)) W. Ger. Pat. Appl. 2,150,592. 9p., April 19, 1973. (3 claims).*

Mercury is removed from roasting gases by adsorption with active carbon, impregnated with sulfur by treatment with sulfur dioxide or with hydrogen sulfide and SO2 alternately. Thus air containing 15 mg Hg/cu m was cleaned to 0.05 mg/cu m. For the adsorption process the activated coal-filled column and the gas passing through the column should have a temperature between 10 and 50 C for avoidance of water condensation in the activated coal. Prior to passage of the roasting gases through the column they are liberated from dust and sulfur trioxide mist.

41601 **APTIC NO. 64226**

North Atlantic Treaty Organization, Committee on the Challenges of Modern Society

UNITED STATES LPPSD TECHNICAL INFORMATION EXCHANGE. DOCUMENT NO. 1. A SUMMARY REPORT OF THE ADVANCED AUTOMOTIVE POWER SYSTEMS CONTRACTORS COORDINATION MEETING, ANN ARBOR, MICHIGAN. RANKINE ENGINES - JUNE 5, 1973, COMBUSTION SYSTEMS - JUNE 6, 1973, GAS TURBINE ENGINES - JUNE 7, 1973. *280p., 1973.*

The presentations and discussions of the Contractors Coordination Meeting are reviewed to present information on the Low Pollution Power Systems Development program. The program is reviewed, including its goals, perspective on fuel economy, progress, and the status of Rankine and gas turbine engine development. Several companies are developing Rankine (steam) systems. The results of their studies and engine performance tests are reviewed. The California Clean Car Program to develop two demonstration vehicles powered by Rankine engines is also reviewed. The status and exhaust emissions (nitrogen oxides, carbon monoxide, and hydrocarbons) from five companies developing low-emission Rankine engines are reviewed. The characteristics, performance, technology, and emissions for various programs to develop gas turbine engines are reviewed. Costs, fuel economy, heat exchange, and other factors are mentioned. Several programs related to low emission engines and energy conservation are also discussed including an investigation of the health hazard from nickel-oxide rubbing seal materials, a study of alternative fuels and electric cars, a light duty diesel engine program, a study on rubber pattern casting techniques for low cost turbine wheels, a fluidic turbine inlet gas temperature sensor, a gas turbine engine production implementation study, and a study of the Stirling engine.

41602 **APTIC NO. 64295**

(Inventor not given.)

PROCESS FOR THE OPTIMUM ABSORPTION OF ELEMENTARY SULPHUR FROM NATURAL GAS BY USING MINERAL OIL OR SIMILAR LIQUID HYDROCARBONS. *(Wintershall Aktiengesellschaft, Kassel (Germany)) Brit. Pat. 1,336,315. 4p., Nov. 7, 1973. (Appl. Nov. 23, 1970, 17 claims).*

A process for the absorption of elementary sulfur from natural gas is described which allows for treatment of higher sulfur content gases than similar prior art methods. The process involves adjusting an ascending circular flow moving upwardly on a borehole wall and the use of mineral oil or similar liquid hydrocarbons in a two-phase system with natural gas such that elementary sulfur is distributed in vapor form and transferred from the natural gas into the mineral oil fraction. The mineral oil fraction is added at the rate of 200-4000 l/hr at the lowest point of the borehole to the ascending gas stream with a delivery of 1000-40,000 cu m n/hr, while maintaining a ratio of mineral oil to natural gas of 1:4 to 1:20.

1972

41603 **APTIC NO. 63798**

Adams, Clark E. and William T. House

SLURRY HYDRODESULFURIZATION OF A HEAVY PETROLEUM OIL. *(Esso Research and Engineering Co., Baton Rouge, La.) U. S. Pat 3,668,116. 6p., June 6, 1972. 7 refs. (Appl. Oct. 16, 1970, 17 claims).*

An improved hydrodesulfurization process for the production of industrial fuel oil as the major product by treatment in a reactor as an oil-catalyst slurry is described. The process comprises treating a heavy petroleum oil in a slurry operation with hydrogen and a catalyst comprising an oxide or sulfide of nickel or cobalt and an oxide or sulfide of moylbdenum or tungsten deposited upon a support material made in a particular way and having certain properties. The process is carried out at non-destructive low conversion reaction conditions to produce a maximum amount, i.e., 75-100%, of industrial fuel oil. Slurry operation offers advantages over other types of contacting used for hydrodesulfurization of heavy oils. The essential feature of this method of contacting is a moving three-phase system in the reaction zone. The solid catalyst is in oscillating suspension as an expanded bed in the moving liquid oil steam forming a slurry and the hydrogen gas passes through the slurry at a controlled rate.

41604 **APTIC NO. 65886**

Aleta, C. R. and F. C. Gouldin

REVIEW OF TECHNOLOGY FOR THE CONTROL OF EMISSIONS FROM FOSSIL FUELED ELECTRIC POWER STATIONS. *Cornell Univ., Ithaca, N. Y., National Science Foundation Contract GI-29903X, Rept. 72-21, NSF/RA/N-72-022, 76p., Aug. 1972. 83 refs.*

NTIS: PB 227823

Technologies and strategies for reducing emissions of sulfur oxides nitrogen oxides, and particulates from fossil fired central power stations are reviewed based on a literature survey, questionnaires sent to power companies and suppliers, and interviews with technical and managerial personnel involved with emission control. Available options include: low sulfur fuels, electrostatic precipitators, tall stacks, nuclear power, and combustion modifications. Soon to be available technologies consist mainly of various SOx gas cleaning systems and fluidized bed boilers; while future technologies involve combined cycles, coal gasification to low or high BTU gas, and a coal cleaning process for sulfur and ash removal. Cost estimates and efficiency ratings for the various systems are preserved, where possible. (Author abstract modified)

41605 **APTIC NO. 63530**

Anderson, Catherine E.

POTASSIUM PERMANGANATE CONTROL OF CERTAIN ORGANIC RESIDUES IN AIR AND WASTEWATER. *Inst. of Advanced Sanitation Research, International, Prog. Hazardous Chem. Handl. Disposal, 3rd, Proc. Symp., Indianapolis, Ind., 1972, p. 177-186. 10 refs.*

The use of potassium permanganate in the treatment of wastes contaminated with organic residues is discussed. The use of KMnO4 as the scrubbing liquid in air scrubbers is growing. Its limitations lie in its accumulation in the scrubbing solution, unless removed by filtration or settling, and can be a cause of autodecomposition of the KMnO4. Frequent cleaning of the packing material is necessary. It is a versatile and powerful oxidizing agent, but is relatively expensive and produces manganese dioxide as a reaction by-product. It is an effective agent for controlling phenol, formaldehyde, cyanides, sulfur compounds, and pesticides. It is being used for controlling various organics that cause taste and odor problems in potable water; in scrubbers in the rendering, food processing, and roofing materials industries; and as a final waste treatment step in control of phenols and cyanides. More stringent standards for the quality of waste effluents (both air and water) will perhaps lead to increasing use of KMnO4 for removal of traces of contaminating organic residues.

41606 **APTIC NO. 63684**

Ashley, Kenneth

RECHARGEABLE GAS CLEANERS. *(Hymatic Engineering Co., Ltd., Redditch (England)) U. S. Pat. 3,683,596. 4p., Aug. 15, 1972. 6 refs. (Appl. April 28, 1970, 1 claim).*

A rechargeable gas cleaner, sealed against contamination from its surroundings is described. It comprises a cartridge in a cylindrical casing open at both ends having inlet and outlet ports in its cylindrical wall communicating through ports in the cartridge with cleaning material in the cartridge. For replacement of the cartridge, a fresh cartridge is enclosed in a storage capsule comprising a flexible plastic bag and a rigid head incorporating a readily breakable diaphragm. The head of the capsule is applied to the casing, and the cartridge is pushed by means of the flexible bag into the casing, breaking the diapraghm and pushing the old cartridge out, followed by diaphragm. The gas cleaning material can be either an absorbent or an adsorbent. (Author abstract modified)

41607 **APTIC NO. 64280**

Astrup, Poul

SOME PHYSIOLOGICAL AND PATHOLOGICAL EFFECTS OF MODERATE CARBON MONOXIDE EXPOSURE. *Brit. Med. J. (London), 4(5838);447-452, Nov. 25, 1972. 31 refs. (Presented at the Royal College of Physicians of London, Lilly Lecture, Oct. 30, 1972.)*

The toxic effects of carbon monoxide are reviewed, and investigations on the effects are discussed. Rabbits fed cholesterol were exposed to 0.017% CO for 10 wk giving carboxyhemoglobin concentrations around 15%. This resulted in a cholesterol content 2.5 times higher than in control rabbits. By intermittent exposure of groups of 18 rabbits each to CO for 12 or 4 hr/day, 0.3 and 5.0 times more cholesterol accumulation than by continuous exposure occurred. Groups of rabbits were exposed to various degrees of hypoxia which caused cholesterol concentrations in the aortic walls 3-3.5 times higher than control groups. Thus, lipid accumulation in the arterial walls of cholesterol-fed rabbits was highly influenced by the composition of the air the animals breathed. The accumulation was increased by hypoxia and CO and decreased by hyperoxia. Macroscopically as well as microscopically there was no qualitative difference between the lesions in animals exposed to CO and those exposed to hypoxia. Macroscopically it was easy to distinguish between the aortas from exposed animals and control animals by the number and size of plaques. Microscopic changes were more pronounced in the exposed animals. In animals not receiving cholesterol, moderate CO exposure produced arterial lesions with pronounced focal subendothelial oedema indistinguishable from spontaneous arteriosclerosis. A pathophysiological explanation is given of the experimental findings and of the relation to the pathogenetic mechanisms in the development of arteriosclerosis in man. The results were consisten with older experimental studies along similar lines. The relation of the development of atheromatosis to increased vascular permeability and the filtration theory are discussed. The metabolic concept and the effect of carboxyhemoglobin on fetal development are also discussed. Small amounts of carboxyhemoglobin in the blood do have a significantly harmful effect, and exposure to CO by smoking may increase arerial disease. The toxicity of low concentrations of carboxyhemoglobin should be considered when discussing thresholds and air pollution.

41608 **APTIC NO. 63438**

Belohradsky, J.-J.

RECOVERY OF THE EXHAUST GAS ENGINE IN MARINE ENGINES. *(Abgasenergieausnutzung in Schiffsmotorenanlagen). Text in German. Brennstoff-Waerme-Kraft, 24(11):411-415, Nov. 1972. 13 refs.*

The possibility and design problems concerning the recovery of the exhaust gas energy from high-power diesel engines in ships are described with respect to rated power and partial load conditions. The engine power can be considerably increased by the recovery of the exhaust gas energy in exhaust-driven superchargers. The thermal energy of the exhaust gas can be recovered in waste-heat boilers for the generation of heat, hot water, or steam for electricity generation, and the latter is possible by a combination of the waste-heat boiler with turbine generator. To prevent dew-point corrosion due to sulfur dioxide in the waste-heat boiler, the exhaust gas temperature should be at least 160 C in any point of the boiler.

41609 **APTIC NO. 64399**

Beveridge, Thomas R. and Ernst L. Ranft

EVAPORATION LOSS CONTROL. *(General Motors Corp., Detroit, Mich.) U. S. Pat. 3,683,597. 10p., Aug. 15, 1972. 3 refs. (Appl. Sept. 17, 1970, 13 claims).*

A system for controlling the loss of fuel vapor from vehicle fuel tanks is described. The fuel tank vents are connected to the uppper portion of a canister containing a quantity of fuel vapor adsorbing carbon retained under compression. The upper portion of the canister is also connected to the induction system of the vehicle engine. The bottom of the canister is open to the atmosphere so that air is drawn through the C and the fuel vapor purged during engine operation. The canister is molded from nylon and the top is formed so that vapor from the fuel tank is discharged into the mid-portion of the canister. The top and bottom of the canister include molded grids and filter pads to prevent loss of carbon from the canister. A nylon screen can be added to prevent C loss from the bottom of the canister. The top of the canister may contain appropriate valve structures to control fuel tank pressure and vapor flow. (Author abstract modified)

41610 **APTIC NO. 63612**

Brogan, John J.

PROSPECTS OF ALTERNATE POWERPLANTS. *Society of Automotive Engineers, Inc., New York, Environmental Protection Agency, and Dept. of Transportation, Soc. Automotive Engrs. Int. Conf. Transp. Environ., Proc., Washington, D. C., 1972, Part I, p. 103-107. (May 31-June 2, Paper 720616.)*

The Clean Air Act Amendments of 1970 require that new model automobiles of 1976 and later meet stringent exhaust emission standards. The technical difficulties appearing in the cleanup of the conventional automobile engine require that alternate engines be developed in the event that the conventional engine cannot be made to meet the standards. Although the alternates cannot be mass produced by 1976, prototype engine development and demonstration by that data may lead to decisions to mass produce one or more in the early eighties. Features of the major alternate engine systems are reviewed, and projections are made of the prospects of each as a replacement for the conventional engine. The introduction to production of rotary Otto cycle systems by the mid-1970 s, gas turbines by the early 1980 s, and high performance all-electric systems by the late 1980 s is projected. Other alternate systems considered are the stratified charge engine, Rankine cycle systems, diesel cycle systems, hybrid systems, and Stirling cycle systems. (Author abstract modified)

41611 **APTIC NO. 63832**

Burbidge, Bernard Whiting, Ian Montgomery Keen, and Christopher Ronald Pout

HYDROCATALYTIC PROCESS FOR NORMAL PARAFFIN WAX AND SULFUR REMOVAL. *(The British Petroleum, Co., Ltd., London (England) U. S. Pat. 3,668,113. 4p., June 6, 1972. 6 refs. (Appl. Sept. 22, 1969, 5 claims).*

Hydrocarbon fractions, particularly petroleum fractions of 30-650 C boiling range and containing 0.1 - 3.0 wt% sulfur 5-50 wt% n-paraffin wax, are reduced in sulfur and n-paraffin wax content by hydrocatalytic treatment at 260-482 C and 50-3000 psig, first over a catalyst of a Group VI or VIII hydrogenating component on a mordenite of reduced alkali metal content to remove n-paraffin wax and then over a catalyst of a group VI or VIII hydrogenating component and a refractory inorganic oxide to remove sulfur. Diesel fuels or fuel oils are separated from the desulfurized product. Preferred catalysts are platinum on decantenized mordenite and cobalt-molybdenum on alumina used repsectively in amounts of 10-90 and 90-10 vol%, preferably 20-60 and 80-40 vol%. The feedstock must contact the mordenite catalyst first since this is sensitive to hydrogen sulfide and if gas is recycled from the sulfur removal to the n-paraffin was removal stage this should be treated to remove H2S. Processes are known for both sulfur removal and for the removal of n-paraffin wax, which are the main cause of high pour points in petroleum fractions, but carrying out the processes separately is expensive. Both steps can be carried out in the same reaction system observing certain precautions.

41612 **APTIC NO. 63622**

Cantwell, E. N., R. A. Hoffman, I. T. Rosenlung, and S. W. Ross

A SYSTEMS APPROACH TO VEHICLE EMISSION CONTROL. *SAE (Soc. Automotive Engrs) Trans., vol. 81:1732-1750, 1972. 18 refs.*

A total emissions control system (TECS) consisting of exhaust manifold thermal reactors, exhaust gas recirculation, exhaust particulate trapping, and appropriate engine adjustments was studied to reduce all gaseous and particulate emissions from passenger vehicle exhaust. The first generation system was designed to meet the former U. S. and California emission standards for 1975. Field and service tests demonstrated that the emission standards were met, but unexpected operational problems were encountered. Solutions to these problems were found. Second generation total emission control systems are being developed to meet the new, current emissions standards for 1975-1976. These systems, in their present state of development, produce very low exhaust emission levels; the hydrocarbons are well below the standards, and the carbon monoxide and nitrogen oxide levels are quite close to the 1975-1976 standards. Possible approaches to reduce the emissions even further and to alleviate partially the losses in fuel economy are discussed. The control system is described, emission test results for first and second generation vehicles are reviewed, and durability is described. (Author abstract modified)

41613 **APTIC NO. 64036**

Chwalibog, H.

PURIFICATION OF WASTE GASES FROM SULFURIC ACID FACTORIES. *(Oczyszczanie gazow odlotowych z fabryk kwasu siarkowego). Air Conserv. (English Translation from Polish of: Ochrona Powietrza), 6(5-31):15-26, 1972.*

NTIS: TT 72-54023/5

Physical and chemical methods are outlined for the removal of sulfur compounds from waste gases in sulfuric acid factories. Three types of demisters (H2SO4 mist eliminators) are described: one for removing drops 3 micron and upward, a high performance unit with an altered fiber pattern to allow for Brownian movement by fine aerosol particles, and a quick-acting unit for high flow rates. Chemical methods for quantitative reduction of sulfur dioxide from stack gases are covered in terms of chemical absorption, double absorption, and wet catalysis. Data are presented to show that from an environmental protection point of view the ammonia absorption method (chemical absorption) is more satisfactory than double conversion. Both technologies appear inadequate from an economic standpoint in view of increasing H2SO4 output at some factories. A new manufacturing technology for H2SO4 using oxygen in place of air is cited as offering practically complete elimination of pollution and allowing for miniaturization of acid apparatus.

41614 **APTIC NO. 64137**

Cook, Harvey Arthur

MIXTURE-COMPRESSING ENGINE. *(Brennstoffeinspritzsystem ruer eine gemischverdichtende Brennkraftmaschine). Text in German. (TRW, Inc., Cleveland, Ohio) W. Ger. Appl. 1,938,687. 11p., Feb. 10, 1972. (4 claims).*

A mixture-compressing engine fuel injection system is described with a permanently-open nozzle downstream of a throttle in each cylinder intake, avoiding any fuel vapor escaping into the atmosphere when the engine is stopped. The pneumatically operating valve controlling the fuel supply when closing works with an adjustable stop, and when opening is followed by a setting piston against a spring acting in the closing direction. The control pressure chamber regulating the valve is subjected on the one side via a pneumatic shutter to the pressure downstream of the throttle, and on the other side is connected to the reference pressure chamber, which is in turn connected to the air intake, dependent on the difference between reference and atmospheric pressures. When the reference pressure falls, the connection between reference and control chambers is interrupted.

41615 **APTIC NO. 63529**

Eckert, John S.

HANDLING AND DISPOSAL OF DANGEROUS AND TOXIC SUBSTANCES USING PACKED WET SCRUBBERS. *Inst. of Advanced Sanitation Research, International, Prog. Hazardous Chem. Handl. Disposal, 3rd, Proc. Symp., Indianapolis, Ind., 1972, p. 33-45. 9 refs.*

The use of wetted packed beds for the removal of contaminants from gas streams is described. Though many of these materials, toxic gases and the vapors of toxic substances, may be removed from a gas stream by simple countercurrent water scrubbing over a packed bed, the more usual technique uses counter or cocurrent means to scrub the substance from the gas stream with a reactive solution. This solution may be used to destroy the substance, usually by strong oxidation processes or simply by forming a compound with it which may be allowed to build up in concentration to be disposed of as a concentrated solution or as a sludge. When a noxious or poisonous substance is to be removed from a gas stream, three important considerations must be used in deciding on a device and a process: size of equipment which relates to capital expenditure, cost of operation both in power and materials, and compatability of process. Along with the relatively large amount of water required to do an efficient scrubbing job on some of these gases, it is a further problem that either now or in the very near future, it will no longer be possible to discharge this water into streams because of either toxic or environmental effects such as pH shift of the water. It will be necessary in such cases to react the scrubbed material in the liquid phase to yield a harmless chemical.

41616 **APTIC NO. 64063**

Engels, Uwe

EXHAUST GAS RETURN CONTROL. *(Steuereinrichtung fuer die Rueckfuehrung von Auspuffgas in die Ansaugleitung einer gemischverdichtenden Brennkraftmaschine). Text in German. (Deutsche Vergaser GmbH and Co. KG, Neuss (Germany)) W. Ger. Pat. Appl. 2,247,587. 6p., Sept. 28, 1972. (4 claims).*

The amount of gas recirculated by an internal combustion engine is regulated by two controls in series, one operated by the pressure downstream of the throttle butterfly, and the other by a parameter directed from the exhaust gases between engine and exhaust silencer. The first control closes as pressure rises in the intake, and the parameter detected from the exhaust gases is the pressure of the latter. The second control also reacts to the pressure in the narrowest part of the venturi in the intake, upstream of the butterfly. A further control can be incorporated, operated by the pressure at apertures in the intake wall upstream of the idling position of the butterfly. The intensity and/or the time constant of the factor operating each control can be adjustable.

41617 **APTIC NO. 63528**

Gibson, R. O. and D. J. Vinson

DESIGN AND INSTALLATION OF SMOKELESS FLARE SYSTEMS FOR GASOLINE PLANTS. *Preprint, American Society of Mechanical Engineers, New York, 5p., 1972. 1 ref. (Presented at the American Society of Mechanical Engineers, Petroleum, Divison, Petroleum Mechanical Engineering and Pressure Vessels and Piping Conference, New Orleans, La., Sept. 17-21, 1972, Paper 72-Pet-12.)*

The design and installation of smokeless flare systems at two gasoline plants to control the air pollution normally associated with the venting and burning of waste hydrocarbons are described. Liquid hydrocarbons were collected using classifier sumps and two-phase separation from the open and closed drain systems. The vapors were burned in an essentially smokeless system. The smokeless flare consists of a burner tip with threee pilots, a seal device to keep air from flowing back into the flare line, a water spray system (or steam spray), and a gas flow sensor to control the water (or steam) spray. The overall performance of the system was good.

41618 **APTIC NO. 65929**

Hartman, Miloslav and Robert W. Coughlin

OXIDATION OF SO2 IN A TRICKLE-BED REACTOR PACKED WITH CARBON. *Chem. Eng. Sci., vol. 27:867-880, 1972. 17 refs.*

The steady state continuous, countercurrent contacting of sulfur dioxide-bearing air with water in a column packed with carbon was modeled. The classical treatment for gas absorption was combined with expressions for the rate of transport through the liquid and for the rate of catalytic oxidation of SO2 within the porous C. This process is closely related to schemes which have been developed for the commercial desulfurization of flue gas. Steady state experiments were carried out in a small trickle bed reactor, 31.5 mm inside diameter packed with carbon pellets of average size. Mass transfer coefficients were estimated from correlations and effective reaction rate relations were developed from experiments conducted in well stirred vessels. Using these parameters and treating the wetted fraction of the C external surface area as an adjustable parameter, good agreement between model and experiment was obtained. (Author abstract modified)

41619 **APTIC NO. 64071**

Hausberg, Gerhard and Karl-Rudolf Hegemann

STEELWORK GAS DUST REMOVAL. *(Anlage zur Entstaubung der in einem Stahlwerksbetrieb anfallenden Abgase). Text in German. (Gottfried Bischoff Bau kompl. Gasreinigungs-und Wasserrueckkuehlanlagen KG, Essen (Germany)) W. Ger. Pat. Appl. 2,239,373. 8p., Aug. 10, 1972. (3 claims).*

A wet dust removal plant for steelworks converter exhaust gases can be connected conventionally via suction ducts with slide valves plus trap hoods to these sources. The converter gas duct remover has an additional suction unit for charging gases with a suction duct, wetter, annular gap washer, following separator and takeoff, and a suction crown for edge zones, mixed heavily with air, of gases emerging from the converter mouth. The crown is connected via a further suction duct to the wet remover, whose wash water circuit is connected to the converter gas dust remover, from which the water returns to the clarifying tank for recirculation.

41620 **APTIC NO. 64218**

Hausberg, Gerhard and Karl-Rudolf Hegemann

BLAST FURNACE GAS SCRUBBING. *(Verwendung einer einstellbar ausgebildeten Ringspaltwaschvorrichtung in einer Gichtgas- Reinigungsanlage fuer Druckhochoefen). Text in German. (Bischoff, Gottfried Bau kompl. Gasreinigungsund Wasserueckkuehlanlagen KG, Essen (Germany)) W. Ger. Pat. Appl. 2,049,903. 4p., April 20, 1972. (4 claims).*

An adjustable annular-gap washer is used for blast furnace gas in a pressurized blast furnace. It consists of a collector dust catcher, washing tower(s) followed by the washer, takeoffs, adjustable pressure reducers, and regulation circuits. Adjuster(s) in the circuits keep the gas pressure constant emerging from the furnace throat, above the minimum pressure difference required for optimal gas cleaning, so that the washer operates only in the linear part of its characteristic.

41621 **APTIC NO. 63614**

Hedrich, H. and P. J. Gaede

ENVIRONMENTAL ASPECTS OF NEW TRAFFIC TECHNOLOGIES. *Society of Automotive Engineers, Inc., New York, Environmental Protection Agency, and Dept. of Transportation, Soc. Automotive Engrs. Int. Conf. Transp. Environ., Proc., Washington, D. C., 1972, Part I, p. 286-291. (May 31-June 2. Paper 720641.)*

The aspects of comprehensive environmental protection must be taken into account in the conception of any technical development. Therefore, operation at a low noise level with exhaust-free propulsion is among the primary demands for the TRANSRAPID and TRANSURBAN mass transportation systems. These systems are based on the principle of contact-free support and guidance of the vehicle by magnetic noise. The systems, propelled by linear induction motors, are exhaust- and noise-free. These unconventional transportation systems are compared with conventional systems. Air pollution in West Germany is described. While automobiles cause exhaust pollution, fallout, noise, and interference with the landscape or city architecture, high-speed and urban linear induction systems cause no environmental impacts in these fields. Railways cause noise and interference with landscape; aircraft cause exhausts, fallout, and noise. (Author abstract modified)

41622 **APTIC NO. 63869**

Higaki, Kiyoshi, Hideo Takechi, Satoru Yanase, Kiyotaka Senba, and Keijiro Kurita

STUDY ON THE CHEMICAL REMOVAL APPARATUS OF SULPHATE INCLUDED IN STACK GAS OF MANUFACTURES. *(Haien datsuryu sochi no kenkyu (daiippo)). Text in Japanese. Ehime Prefectural General Chemical Technological Guidance Office (Japan), Rept. 10, 6p., Sept. 1972. 6 refs.*

A test model for a stack gas desulfurization system was constructed and its efficiency was examined. The system comprises an oil fuel furnace (0.9 by 0.9 by 0.9 m), a burner, a heat exchanger around the flue, a shower room for cooling and dust collection, a desulfurization tower, a flue and a stack with a sirocco fan. The desulfurization tower is a cylinder of 242 m diameter (approximately twice the size of the cross section of the flue), 1.2 m high, about 1 m of which is packed with stainless lathe powder and the remaining 20 cm of which is a shower which supplies atomized caustic soda solution. Stainless powder is durable, its pressure loss is small, and its surface area is large. The fuel combustion gas from the furnace passes through the flue and enters the cooler-dust eliminator tank. The dust is eliminated and the temperature is lowered. The gas moves onto the flue and enters the lower part of the desulfurization tower and, rising through the stainless powder layer which is wet with caustic soda solution, sheds its sulfur content and goes out of the stack. Conditions were changed to see the results of changing fuel consumption between 4-8 l/hr, caustic soda solution consumption, between 0.5-4 l/min, caustic soda solution concentration between 0.3-5%, and desulfurization tower temperature between 40-60 C. A good desulfurization efficiency of 400-500 ppm to 20-30 ppm was achieved with 0.3-0.5% caustic soda solution. Further experiments are necessary to perfect this system.

41623 **APTIC NO. 64069**

Hirao, Motoaki

HYDRAULIC NON-RETURN DEVICE FOR A GAS DUCT. *(Hydraulische Sperrvorrichtung gegenueber Rueckstroemung bei Gasrohrleitungen). Text in German. (Kawasaki Jukogyo K.K., Kobe, Hyogo (Japan)) W. Ger. Pat. Appl. 1,758,425. 3p., March 30, 1972. (6 claims).*

A hydraulic backflow preventer for gas ducts of the exhaust gas system of an oxygen blowing converter with intermittent feeding of uncombusted exhaust gases has a gas inlet pipe which dips into the barrier liquid, and which is movably carried by a float via a support such that it can freely rise or fall corresponding to the water level at the gas outlet side.

41624 **APTIC NO. 63736**

Imase, Wataru and Shunji Suzue

THE WET TREATMENT METHOD FOR WOOD CHIP COMBUSTION BOILER COMBUSTION GAS. *(Kikuzu nensho boira haigasu no shisshiki shori ni tsuite). Text in Japanese. Tokushima-ken Kogyo Shikenjo Kenkyu Hokoku (Tokushima Prefect. Ind. Exp. Stn. Rep.), 1972:5-6, 1972.*

A wet method of wood chip combustion boiler gas treatment was tested for future application on an industrial scale. The boiler capacity was 200 kg/hr of wood chips, with a thermal area of 36 sq m. The combustion gas dusts were sampled by a dust tube inserted in the stack, and the ratio of particle sizes by quantity of dust was examined. Boiler combustion gas contained 30% of particles less than 10 micron, and had a large range of particle sizes, making it difficult to treat. The wet treatment system tested comprises a gas cooling tank, a blower, a wet treatment tank with four spray nozzles, and a clean air exit. The water is circulated by a pump outside the tank. With a treatment gas of 1013.2 N/cu m, 1.205 N/cu m dust at the entrance, the dust concentration at the exit was 0.3556, and the dust collection rate 70.6%. With 3082.6 [illegible] m of the treatment gas, the dust concentration at the entrance was 1.102 g/N cu m, at the exit, 0.321 N/cu m, the collection efficiency, 70.9%.

41625 **APTIC NO. 63683**

Kent, Roger E.

GAS SCRUBBER HAVING TILTABLE GRIDS AND METHOD OF USING. *(National Dust Collector Corp., Skokie, Ill.) U. S. Pat. 3,683,593. 7p., Aug. 15, 1972. 3 refs. (Appl. April 23, 1970, 15 claims).*

A gas scrubber is described comprising a housing having an inlet for contaminated gas adjacent to the lower end and an outlet for cleaned gas adjacent to the upper end. A filter end extends across the housing between the inlet and the outlet. It includes a supporting grid structure and a plurality of separate, movable, filter elements stacked several layers deep on the grid. Adjustable support is provided for tilting the grid structure in the housing relative to the horizontal, and a control means is included for automatically adjusting the support means to change the angle of tilt, thereby effecting lateral displacement of the filter elements around the filter bed to provide self-cleaning of the elements. This scrubber can be used to collect and remove contaminant particles and fume from industrial gases. This scrubber eliminates the problem of filter bed clogging which reduces the efficiency of the scrubber. (Author abstract modified)

41626 * **APTIC NO. 63617**

Lazo, Luis R. and John B. Bohle

PERSONAL RAPID TRANSIT SYSTEMS AND THEIR RELATIONSHIP TO THE ENVIRONMENT. *Society of Automotive Engineers, Inc., New York, Environmental Protection Agency, and Dept. of Transportation, Soc. Automotive Engrs. Int. Conf. Transp. Environ., Proc., Washington, D. C., 1972, Part I, p. 315-323. 10 refs. (May 31- June 2, Paper 720646.)*

Qualitative and quantitative data are presented on the relationship of emerging Personal Rapid Transit (PRT) systems and the environment. The PRT system consists of four to ten passenger vehicles with a mix of larger vehicles potential during peak periods; the system operates on a demand mode basis except during peak periods, during which parts of the system are operated on a designated destination mode; vehicles operate automatically on dedicated and usually elevated guideways; the system uses electricity for the prime power source. These systems are compared with the U. S. air pollution inventory and the automobile. The three main pollutants from the PRT systems come from the generation of electricity in power plants -- oxides of nitrogen, oxides of sulfur, and ash. Thermal pollution will have a minimal near-term impact, and air pollution will be near term. As the number of working systems grow, improvements in efficiency should minimize the thermal pollution problem. The PRT systems should meet noise standards. In a comparison of PRT and conventional automobile pollution, the PRT would fare very well today; as nuclear power is used more for power generation, PRT becomes more attractive. Visual aesthetics of guideway, station, and vehicle design are presented as the most challenging remaining problem in the integration of the PRT systems into society. (Author abstract modified)

41627 **APTIC NO. 65926**

MacLeod, J.

FUEL OIL--ITS IMPACT ON AIR POLLUTION AND EFFECTS OF ADDITIVES. *Energy Int., 9(2):24-29, Feb. 1972. 23 refs.*

Increase in fuel oil use for power generation will cause an increase in the potential formation of sulfuric acid which can caus corrosion and deposits and increased emission of sulfur dioxide, sulfur trioxide, and other emissions. Present technology does not permit stoichiometric combustion with exactly enough oxygen to burn carbon to carbon dioxide, hydrogen to water, and sulfur to SO2 without SO3 formation. Efforts have been made to improve furnace performance. Another method of reducing SO3 formation is addition of metals or other material into the air stream to combine preferentially with atomic formation. The effects of additives on SO3 formation and reduction are discussed. The history of stack emissions is reviewed and related to the variables which affect the annual cost of operation of a fuel oil-fired steam generating unit. Suitable additives to reduce corrosion can also reduce particulate and gaseous emissions. Magnesium oxide injection can reduce total dust emission by 48% and unburned carbon by 74%. Magnesium oxide also reacts with SO3 to precipitate MgSO4. Use of a magnesium-oxide-alumina additive will not only reduce corrosion, but will also maintain dust resistivity in a good range so that the electrostatic precipitator can be in continuous service.

CONTROL METHODS

41628 **APTIC NO. 64362**

McCrink, Edward J.

SMOG REDUCER. *(Assignee not given.) U. S. Pat. 3,683,625. 4p., Aug. 15, 1972. 7 refs. (Appl. May 25, 1970, 9 claims).*

A silicon carbide resistance electric heating element is described which can be incorporated into the exhaust system of an automobile. The heating of the exhaust gases in this element will, with the addition of extra air, convert carbon monoxide in the exhaust to carbon dioxide. In a preferred form of the invention, an exhaust analyzer is connected to the exhaust system downstream from the heating element and controls an air auxiliary inlet to admit the proper amount of air to eliminate CO. The heating element can also serve as a muffler. The device can also eliminate unburned hydrocarbons from automobile exhaust. A larger tube using the same principles could be used for oxidizing exhaust gases from heating or industrial plants. (Author abstract modified)

41629 **APTIC NO. 63682**

Merrill, Edward W.

EXHAUST PURIFICATION. *(Charles River Foundation) U. S. Pat. 3,683,626. 7p., Aug. 15, 1972. 9 refs. (Appl. Dec. 14, 1970, 11 claims).*

A device for purification of exhaust gas from an internal combustion engine is described. Previous methods of exhaust gas purification were not aimed at removing particulate matter. This method does remove particulate matter by adding aerosolized particles to the gas that bind the particulate matter upon collision and remove the resultant particles. The exhaust at super atmospheric pressure is cooled to its dew point at that pressure and then admixed with an aqueous aerosol comprising particles of water coated with an oleophilic surfactant, having an average particle size between 0.5 and 5 micron. The resultant mixture is expanded to reduce gas pressure to nearly atmospheric and to reduce the temperature, thereby condensing a significant fraction of water vapor in the initial exhaust mixture on the aerosolized particles. The resulting particles have a size which permits their removal by centrifugation or equivalent means. The method is particularly effective in removing particulate matter and hydrocarbons in exhaust and can be used alone or in conjunction with a means for removing nitrogen oxides. (Author abstract modified)

41630 **APTIC NO. 65829**

Miyabe, Hideya, Hideo Fukuda, Masao Shidara, Fumio Matsubara, Takio Oya, Yukichi Hasuo, and Kenichiro Omato

IMPROVEMENTS OF THE CONTROL OF EXHAUST GAS EMISSIONS AND THE SAFETY OF AUTOMOTIVE VEHICLES. *(Jidosha no haiki taisaku to anzen seikojo no kenkyu). Text in Japanese. Meiji Daigaku Kagaku Gijutsu Kenkyusho Nenpo (Ann. Rep. Inst. Sci. Technol., Meiji Univ.), no. 14:15-16, 1972.*

Research on the manufacturing method, maintenance method, and activation method for reduction catalysts of automotive exhaust gas reviewed. Catalytic thermoresistance and the problem of ammonia formation from nitrogen oxides reduction are also being studied. With regard to the installation of a catalyst, whisker catalyst particles were fixed on a stainless steel web with even intervals. Both 12 and 60 micron wires were tried for the web, but no satisfactory result was obtained. As the web material, SUS 42 stainless steel seems to produce a better result than SUS 27. The pellet alumina carrier studded with catalysts by the segregation method was satisfactory for the oxidation of carbon monoxide, but was not good for NOx reduction activity. For activity conditions, a temperature of about 700 C and a strong reductive gas of air/fuel ratio 13 produced the best result. The NOx reduction activity reaches 90-100% at 500 C, but ammonia formation from nitric oxide reduction reaches a peak of 15% at 600 C and air/fuel ratio 14.5. The ammonia formation decreases to 6% at 700 C. For this reason, 700 C or slightly below is recommended.

41631 **APTIC NO. 64159**

Nelson, W. L.

THE PRESENT STATUS OF RESIDUAL OIL DESULPHURIZATION TECHNOLOGY. *Sulphur, no. 100:55-58, May/June 1972. 34 refs.*

At least nine large commercial-scale plants throughout the world for directly desulfurizing residual oil materials are now on-stream or about to come on-stream. The commercial processes are the Isomax process, hydrodesulfurization (HDS), and H-Oil. The Residfining process, IFP process, and British Petroleum process are being actively developed. The presence of vanadium and nickel in the oil is critical to these processes, because only residuals containing less than 100 ppm or possibly 150 ppm of V and Ni can be handled profitably. A table showing average V contents of major petroleums shows that many sources of oil are unsuitable, but that low-sulfur fuel oils can be produced from the higher gravity crude oils, such as Middle East types. All the processes employ catalysts and involve the recirculation of hydrogen and the use of fixed-bed reactors, apart from the H-Oil process which has its own ebullating-bed reactor. Processing sequences for producing low-sulfur fuel oil most cheaply are presented. Metals can deactivate the catalyst and can be deposited in the catalyst bed. Therefore, the catalyst bed becomes clogged and must be removed and cleaned or repacked. The ebullating bed of the H-Oil process avoids the deposition of metals to some extent, but still has the problem of rapid catalyst deactivation. There seems to be no way to avoid the deposition of metals, therefore, most processes will use catalytic pretreaters.

41632 **APTIC NO. 64138**

Nicklin, Thomas, Joseph Clack, and David Ogden

IMPROVEMENTS IN OR RELATING TO PURIFICATION OF VEHICLE EXHAUSTS. *(Gas Council, London (England)) Brit. Pat. 1,262,076. 2p., Feb. 2, 1972. (Appl. May 8, 1968, 10 claims).*

The invention of a method of purifying the exhaust gases of an internal combustion engine by a catalytic oxidation process is described. Catalytic purification of gases has been suggested as a means of removing unburned hydrocarbons and carbon monoxide, but the known catalysts have shown susceptibility to damage and malfunction at high temperature and have not proved satisfactory in operation. The patent proposes a new and improved catalyst useful in the treatment of exhaust gases from an internal combustion engine. This comprises passing the gases with oxygen over a catalyst consisting of 4 to 10% iron oxide, 5 to 15% nickel oxide, and 4 to 10% uranium oxide. The catalyst may be located within a chamber attached adjacent to the exhaust manifold of the engine and the chamber may conveniently be arranged to serve as an acoustic silencer. A breakdown of percentage removal for each hydrocarbon type has shown that C4-C10 hydrocarbons are removed virtually to completion.

41633 **APTIC NO. 64294**

Nishiwaki, Akio and Yasuo Kato

AGE DISTRIBUTIONS OF SUSPENDED SOLID PARTICLES IN BUBBLE COLUMNS. *(Kihotonai no kendaku kotai ryushi no tairyu jikan bunpu). Text in Japanese. Kagaku Kogaku (Chem. Eng.), 36(10):1147-1150, 1972. 7 refs.*

For designing a bubble tower, the age distribution of particle suspension in the tower must be known. Only few studies have been made in this area. Here, axial age distribution of suspended solid particles was mathematically analyzed and calculated as the settling speed of solid particles, and the average particle concentration in a bubble tower was obtained. A spatial age distribution curve, external age distribution curve, dispersion model, and comparison with actual suspension measurements are discussed.

41634 **APTIC NO. 63799**

Parker, Levi C. and Odes B. Robertson

HYDRODESULFURIZATION PROCESS. *(Texaco, Inc., New York) U. S. Pat. 3,668,112. 5p., June 6, 1972. 2 refs. (Appl. Dec. 6, 1968, 4 claims).*

Low sulfur diesel oil and low sulfur fuel oil are produced by a process which permits the minimum production of materials boiling in the gasoline range. A catalytic hydrodesulfurization process reduces the sulfur content of the portion of the feed charge which is subsequently fractionated into the desired diesel fuel and fuel oil. Hydrocarbons produced in the desulfurization process boiling within the motor fuel boiling range are catalytically cracked to yield substantial quantities of C1 to C4 hydrocarbons. A sulfur-containing hydrocarbon liquid charge stock suitable for the production of diesel oil and fuel oil is contacted, together with hydrogen, in a hydrodesulfurization zone with a hydrodesulfurization catalyst under conditions effecting a reduction in the sulfur content of the charge stocks. (Author abstract modified)

41635 **APTIC NO. 63970**

Saito, Hiroyuki and Wataru Imase

STUDIES ON DUST COLLECTION TECHNIQUES FOR LIME PLANTS. *(Sekkai kojo ni okeru shujin gijutsu ni kansuru kenkyu). Text in Japanese. Tokushima-ken Kogyo Shikenjo Kenkyu Hokoku (Tokushima Prefect. Ind. Exp. Stn. Rep.), 1972:1-2, 1972.*

The cyclone and bag filter designed by the Tokushima Prefectural Industrial Experiment Station were tested at a lime roasting furnace and the efficiency was checked. The lime roasting furnace combustion gas emitted from the top of the furnace contains 0.32-0.75 g/N cu m of dusts, but with the use of the cyclone, the concentration in the gas decreased to 0.11 to 0.25 g/N cu m, with a collection efficiency of 67-69%. The suspended particulates in the plant were sampled by a P-3 digital dust counter, settling particles in the room and in the environment were measured by Petro dishes, and the dusts in the digester and the furnace top combustion gas were measured by the Japanese Industrial Standard Z8808 flue gas measurement method. The digester emission exit dusts are treated by a simple spray tower, utilizing the water from the digester. In the packing room, a bag filter with two fans (5 and 10 hp) with the filtering area of 80 sq m was installed. By this bag filter, the concentration of suspended particulates in each room was reduced more than 90% and the air quality was successfully controlled to the level of the legal standard.

41636 **APTIC NO. 63686**

Schouw, Arthur C.

MODULAR FUME SCRUBBER. *(Assignee not given.) U. S. Pat. 3,683,594. 6p., Aug. 15, 1972. 7 refs. (Appl. Feb. 26, 1970, 2 claims).*

A fume scrubber is described which is in a modular form and adapted to be stacked vertically to multiply unit capacities. Each unit includes internally suspended blowers which are downwardly directed toward a pan of liquid or fluid to enhance removal of contaminants from the vapor or gases or their mixtures. Each unit also includes a plurality of filter bed elements transversely set across the rising column of gases or vapors and entrained contaminants and through which the materials for treatment must pass. A spray is directed counter to the flow through the filter bed. The blower directs influent material downwardly against a fluid bed. Then the gases and/or vapor rise in the chamber to pass through the filter bed to the exhaust. When stacked, adjacent units are spaced apart by collar-like exhaust plenums which may be connected to a common exhaust manifold or stack. This scrubber is more efficient than previous scrubbers and has the advantage of allowing multiplication of capacity by vertical stacking without additional floor space. (Author abstract modified)

41637 **APTIC NO. 65922**

Sinha, R. K. and P. L. Walker, Jr.

REMOVAL OF MERCURY OF SULFURIZED CARBONS. *Carbon, 10(6):754-756, Dec. 1972. 8 refs.*

Use of sulfurized carbons for removing mercury vapors from contaminated streams at 150 C is discussed. Carbon prepared by carbonizing Saran at 900 C was used as the support material for sulfur. Sulfurization of this carbon to three sulfur loadings of 1.0, 4.0, and 11.8% by weight was carried out through oxidation of hydrogen sulfide by oxygen in a fluidized bed. The concentration of Hg in the air stream before and after contacting the sulfurized carbons was monitored. Breakthrough curves of Hg are given. Moisture had a marked effect on reducing the breakthrough time.

41638 **APTIC NO. 64172**

Szarawara, J. and C. Kozik

DRY AMMONIA METHOD FOR UTILIZATION OF SULFUR DIOXIDE IN DILUTED GASES. *(Sucha amoniakalna metoda utylizacji dwutlenku siarki w gazach rozcienczonych). Air Conserv. (English translation from Polish of: Ochrona Powietrza), 6(6);1-11, 1972. 6 refs.*

NTIS: TT 72-54023/6

A method of contact oxidation of sulfur dioxide in waste gases at concentrations less than 1% was studied. Four types of vanadium catalysts were tested. The degree of SO_2 conversion as a function of SO_2 and oxygen concentration, temperature, and time of contact was studied. The influence of carbon monoxide and carbon dioxide in the raw gases on the degree of SO_2 conversion was also studied. This oxidation method of removing SO_2 involves binding SO_2 with gaseous ammonia in the presence of steam and precipitating ammonium sulfate which can be used as a fertilizer. The reaction takes place in a reactor with a fixed catalyst layer. The contact oxidation and precipitation of SO_2 contained in metallurgical waste gases should include the following points: dust should be removed from the waste gases; if necessary, the gases should be preheated to reaction temperature of 450-550 C; oxygen content in the diluted gases should exceed 4% by volume; waste gases may contain carbon and nitrogen oxides, as well as other inert cases, but catalytic poisons such as volatile arsenic compounds should not be present; a contact time of greater than 10 g min/N d cu m should not be provided; and gases leaving the reactor should be cooled and then treated with a stream of gaseous NH_3 in a suitable chamber to precipitate ammonium sulfate.

41639 **APTIC NO. 64171**

Szwed, H.

THEORETICAL ANALYSIS AND TEST RESULTS OF A MECHANICAL-ELECTRIC DUST COLLECTOR. *(Analiza teoretyczna i wyniki badan odpylacza mechaniczno-elktrycznego). Air Conserv. (English translation from Polish of: Ochrona Powietrza), 6(6):12-24, 1972. 7 refs.*

NTIS: TT 72-54023/6

The motion of a gas particle behind the impeller in an axial rotary dust collector is discussed. Test results are presented for a dust collector combining an axial rotary dust collector with a horizontal electrofilter. The connection of a mechanical collector with an electrofilter may produce the effect of vortex transfer from the axial dust collector to the electrofilter, which might alter the work of the latter. This effect and the influence of the axial velocity profile behind the mechanical dust collector on the efficiency of the electrofilter are analyzed theoretically and in the experimental tests. An equation of road, angular velocity, and duration of vortex is derived on a theoretical basis. A comparison of test and theoretical results shows the vortex produced by the rotary dust collector practically decays in the collecting pipe. Consequently, a direct connection of the axial rotary dust collector with the electrofilter will have no adverse effects on the work of the latter. The axial rotary dust collector gives a regular distribution of the velocity field and the dust concentration throughout the cross-section of the electrofilter s chamber. The mechanical-electric collector is little sensitive to wide-range changes in gas flow rates and is insensitive to dust concentrations of 21-5 g/cu m. The use of the mechanical-electric dust collector is economically justified when the overall de-dusting efficiency is higher than 96% and when the efficiency of the mechanical collector is higher than 50%.

41640 **APTIC NO. 63454**

Tatterson, Benjamin Franklin

REMOVING AMMONIA FROM COKE OVEN GAS. *(Verfahren zur Entfernung von Ammoniak aus Koksofengas). Text in German. (Koppers Co., Inc., Pittsburgh, Pa.) W. Ger. Pat. Appl. 2,238,805. 19p., Aug. 7, 1972. (3 claims).*

A method of removing ammonia from coke oven gas is described. The volume of liquid leaving the NH3 separator is diminished in a process using two NH3 separators, where the coke oven gas is cooled by spraying, then washed, and the resulting two NH3-containing solutions are treated in a separator with a lime pan and steam to liberate the fixed and the dissolved or free NH3 and in a second separator to separate the free and/or dissolved NH3. The stripped solution from the first separator is rejected, and the stripped solution from the second separator is at least partly reused as wash liquor for the NH3 washers and is recycled. The NH3 solution from the cooling step and the diluted NH3 solution from the wash step are either treated separately in the first and second separator, respectively, or both in the second separator. In the first case, the entire stripped solution from the second separator is used in the washers; in the second case, part of the solution is fed to the first separator.

41641 **APTIC NO. 64360**

Williams, Theodore M.

INTERNAL COMBUSTION ENGINE EXHAUST BURNER. *(Assignee not given.) U. S. Pat. 3,683,624. 9p., Aug. 15, 1972. 10 refs. (Appl. Sept. 29, 1970, 9 claims).*

An anti-pollution device for use with the exhaust system of a motor vehicle is described. It is preferably mounted in an air foil above the rear deck of an automobile for electrically collecting and burning particles constituting combustion residue from the vehicle engine. Air is supplied to the air foil to provide sufficient oxygen to effect the complete burning of the exhaust residue. The cleaned and purified exhaust gases, after passing through a filter, are discharged from the air foil across substantially its entire length and at an upward angle. The consumed particles of combustion residue are electrically collective while the vehicle is idling or moving at low speed, and are burned and consumed when the vehicle is travelling at a high speed. The exhaust is discharged upward from the vehicle, rather than toward the roadway as in conventional engines. (Author abstract modified)

41642 **APTIC NO. 64081**

Wu, Yau

A NEW POLLUTION FREE TRACKED AIR CUSHION AIR DRIVEN RAPID TRANSIT VEHICLE. *Virginia Polytechnic Inst. and State Univ., Blacksburg, Va., Dept. of Aerospace Engineering, Rept. VPI-E-72-3, 68p., Feb. 1972. 1 ref.*

A new concept of a linear air turbine vehicle is proposed. The tracked air cushion and air-driven rapid transit system is designed for future high speed ground transportation in an urban area. Through the compressed air pipe lines to the passive vehicle, the system employs the principles of compressor, pipe, heating chamber, nozzle, turbine, air cushion, and jet in a new combination. The vehicle contributes no air, thermal, vibration, or noise pollution. Technical, environmental, and economic problems are discussed. The system is very efficient, practical, and economical for future high-speed ground mass transportation in major cities. Two alternative heating systems and their advantages are discussed. The fundamental aerodynamic and thermodynamic process of the whole flow system is described. Two examples of vehicles traveling at 200 and 300 mi/hr are examined aerodynamically and thermodynamically. A general review is given on current studies of air cushion suspension. The overall efficiency and economic feasibility of the engine are discussed. Other applications of such a system besides rapid transit are discussed. A summary of the advantages and limitations of the new transportation system is given. (Author abstract modified)

41643 **APTIC NO. 63621**

Yamaoka, Kojiro and Hiroshi Tado

IMPROVEMENTS OF THE ROTARY ENGINE WITH A CHARGE COOLED ROTOR. *SAE (Soc. Automotive Engrs) Trans., vol. 81:1575-1593, 1972.*

Rotary engines with charge-cooled rotors are discussed. Test results obtained with charge-cooled rotors during the course of engine development are given. With continuing new applications of the NSU/Wankel rotary engine, charge-cooling appears to be a promising feature, especially in small-sized engines, from the point of view of simple structure and improved economy. This improved charge-cooled system gives improved performance for the small rotary engine. Several intake port arrangements can be used with the charge-cooled rotors; the advantages and disadvantages of these systems are discussed. Port timing, compression ratio, combustion chamber shape, spark plug hole and shape, position of the spark plug hole, cooling, and lubrication of the system are also discussed. Several water- cooled engines were developed for agricultural and automotive applications. (Author abstract modified)

41644 **APTIC NO. 64077**

(Inventor not given.)

CYLINDRICAL COMBUSTION CHAMBER FOR AFTERBURNING EXHAUST GASES. *(Vorrichtung zur Nachverbrennung von Abgasen). Text in German. (Eisenmann KG, Maschinenbaugesellschaft, Boeblingen (Germany)) W. Ger. Pat. Appl. 2,115,253. 4p., Oct. 19, 1972. (4 claims).*

A cylindrical combustion chamber for afterburning exhaust gases from a lacquering plant comprises an auxiliary burner and several exhaust gas feeding pipes, which are arranged around a central pipe, and terminate in vortex nozzles outside the flame area for feeding the exhaust gases in the opposite direction to the flame direction.

41645 **APTIC NO. 64165**

Commission of the European Communities (Luxemburg), Directorate General for Social Affairs

TECHNICAL MEASURES OF DUST PREVENTION AND SUPPRESSION IN MINES. SYNTHESIS REPORT ON RESEARCH CARRIED OUT WITHIN THE FRAMEWORK OF THE SECOND PROGRAMME, 1964-1970. *Rept. EUR 4851 d,f,i,n,e, 143p., 1972. 44 refs.*

Research on dust prevention and suppression in mines is reviewed and discussed. Dust suppression and control methods are described including water, water plus additives, dedusters, suspended particulate filters, dust suppression in the face, coal face infusion, infusion methods from the face, Longwall infusion, advance remote infusion, infusion water with additives, infusion shotfiring, and pneumatic stowing. Other dust suppression studies discussed involve suppression on winning equipment and machines, suppression in plough workings and with drum shearers, suppression in the face, caving, suppression other than at the face, suppression during roadheading, roadheading using shotfiring, suppression with mechanized roadheading, suppression during transport, dedusting at face-roadway junctions and loading points, use of evaporation-retardants in winning and other operations, removal of dust sediments in roadways, and other aspects of dust suppression during transport. The properties of dust, light scattering of dust, semi-conductor properties, behavior of dust in mine ventilation systems, dust measurement methods, samplers for size and concentration measurements, methods to measure chemical composition, results of dust research comparative measurements using different measuring devices, and identification of minerals and size distribution are discussed. Research into pneumoconiosis is reviewed including methods, historical evolution, results of epidemiological research, effect of dust exposure and other factors, and continued research.

41646 **APTIC NO. 64216**

(Inventor not given.)

REACTOR FOR AN INTERNAL COMBUSTION ENGINE. *(Reaktor fuer Nachverbrennung der Auspuffgase einer Brennkraftmaschine). Text in German. (Automobiles Peugeot, Paris (France)) W. Ger. Pat. Appl. 2,160,965. 5p., Sept. 7, 1972. (11 claims).*

A reactor of afterburning of exhaust fumes has several concentric walls forming several connected rooms. Inlet sockets for connection to the exhaust pipes open into the internal chamber. The sockets are fastened to the external wall of the reactor and project with free play through apertures in the internal wall. An outlet conduit extends from one of the other rooms. The walls are connected in pairs in the center plane of the reactor in connection points which are staggered from one pair to the next. The wall ends are held by sliding guides. The guides are formed by the cylindrical surfaces of two covers which seal the ends of the internal and the external wall.

1971

41647 **APTIC NO. 64116**

Andrzejewski, M.

POROSITY OF THE DRIP AREA IN SCRUBBERS. *(Porowatosc obszaru kropel w skruberach). Air Conserv. (English translation from Polish of: Ochrona Powietrza), 5(5):52-58, 1971. 6 refs.*

NTIS: TT 72-54022/5

The problem of porosity of drip areas in drip scrubbers is discussed. Drip scrubbers include spray scrubbers and venturi scrubbers. A theory of the dust removal process in drip scrubbers and operation of these devices are discussed by a general formula determining the characteristic parameter of drip area and its relationships with other characteristic parameters of the system. The porosity of drip areas is related to the use of liquid and to the proportion of the gas flow rate to the average velocity of drops in a given area. The relationship between dust removal efficiency and liquid expenditure is also given in an equation.

41648 **APTIC NO. 64191**

Avanzi, Mario

THE ROLE OF LIQUEFIED PETROLEUM GAS IN AIR POLLUTION ABATEMENT. *(Le role des gaz de petrole liquefies dans la diminution de la pollution atmospherique). Text in French. Butane Propane News, 15(57):45-51, 1971.*

The advantages of liquefied petroleum gas as motor fuel in automotive exhaust emission abatement, and its use in Italy are described. The use of liquefied petroleum gas helps abate exhaust emission considerably because this fuel contains no lead, and generates considerably less hydrocarbons, carbon monoxide, and nitrogen oxides in the engine. Moreover, there is no crankcase emission. In Italy, liquefied petroleum gas, distributed by about 500 gas stations in the northern and central parts of the country, is used for cars rather than for commercial and heavy-duty vehicles because most of these latter are equipped with diesel engines, and heavy-duty equipment are not permitted to be equipped with mobile fuel tanks. The cars using liquefied petroleum gas are equipped with a special feed system for the optional use of gasoline and liquefied petroleum gas.

41649 **APTIC NO. 64115**

Billard, F., J. Brion, M. Cousin, and E. Delarne

A FILTER FOR THE PURIFICATION OF HOT COMBUSTION GASES. *(Filtr do oczyszczania gazow goracych pochodzacych z procesow spalania). Air Conserv. (English translation from Polish of: Ochrona Powietrza), 5(2):20-25, 1971. 4 refs. (Presented at the Franco- Polish Symposium, Paris, France, Nov. 1969.)*

NTIS: TT 72-54022/2

A filter is described for purifying hot combustion gases from waste incineration. The regenerable filter consists of candles made of wire netting on which asbestos fibers are deposited pneumatically as the filtration medium. It operates on the principle that unburned particulate matter, especially soot, burns up as it is collected on the filter. Therefore, there is little clogging of the filtering layer and the filter is expected to work for several hundred hours before requiring regeneration. The filter was tested in laboratory scale experiments and as a prototype with a capacity of 20 kg/hr. During filtration at a temperature of 800 C, gases pass at the rate of 15 cu m/hr/candle, which corresponds to a 6 cm/sec filtration rate through the asbestos layer at a pressure drop of 10-15 mm water across the filter. Measured by a Sinclair photometer, the effectiveness of the filtration process is close to 100%. The filter can be used to purify gases from afterburner chambers and from the incineration of radioactive compounds. When the filter is not adequately effective because of the harmfulness of incinerated wastes, it can combined with an absolute filter.

41650 **APTIC NO. 65004**

Boll, Richard H.

PARTICLE COLLECTION AND PRESSURE DROP IN VENTURI SCRUBBERS. *Preprint, American Chemical Society, Washington, D. C., 52p., 1971. 27 refs. (Presented at the American Institute of Chemical Engineers National Meeting, 69th, Cincinnati, Ohio, May 16, 1971.)*

An a priori mathematical model of venturi scrubber performance is developed and compared with experimental data on pressure drop and particle collection. It comprises simultaneous differential equations of drop motion, momentum exchange, and particle impaction on drops. These parameters are readily integrated by computer for the whole venturi, given its configuration and operating conditions. Pressure drop prediction is quite good for a wide variety of venturi sizes and shapes, provided liquor distribution is reasonably uniform. Accuracy of particle collection prediction is only fair. Discrepancies are thought to be due to either maldistribution of spray liquor or condensation of water vapor; thus, provided these conditions are avoided, the model can be used to optimize design and operating conditions for specific applications. (Author abstract modified)

41651 **APTIC NO. 64074**

Clement, John L., Henry P. Markant, and Robert A. McIlroy

EXTRACTION OF SULFUR DIOXIDE FROM MAGNESIUM OXIDE CONTAINING WASTE GASES. *(Verfahren zum Absorbieren von Schwefeldioxyd aus Verbrennungs-Abgaseu). Text in German. (The Babcock and Wilcox Co., New York) W. Ger. Pat. Appl. 1,692,831. 6p., Oct. 28, 1971. (6 claims).*

Sulfur dioxide is extracted from waste gases which are formed in the regeneration of spent sulfite liquor obtained in papermaking by the use of 1 or more venturi-type scrubbers working in series. The gases are passed at 48.9 C and 3 m/sec through a column filled with a liquid absorption medium of which the sulfite content lies within the solubility limits of the system magnesium oxide-SO2-water. The solution is sprayed into the reaction zone at a weight ratio of 5:1 or greater to that of the gas at entry. Preferably the sulfite content of the contacting solution is controlled in each zone.

41652 **APTIC NO. 63413**

Derbin, George M.

DISPERSION ENAMELS -- A STEP IN THE RIGHT DIRECTION. *Preprint, Chemical Coaters Assoc., 4p., 1971. (Presented at the International Anti-Pollution Coating Seminar, 1st, Chicago, Ill., Dec. 12-14, 1971.)*

Nonaqueous dispersions (NADs) are a class of coatings that are not soluble in their solvent medium. Thermosetting type NAD finishes can be used as automobile coatings. They are economical and less pollution-forming. They are formulated with nonphotochemically reactive solvents and make possible acrylic enamels that are 20-30% higher solids at equal viscosity than solution acrylic enamels. This means there are less solvent and more paint solids per drum, and less solvent is emitted to the air while applying NAD s to automotive bodies. The NAD enamels will build 40% more film than current acrylic enamels. Thus, only two coats are needed instead of three. This enables the assembly plant to use only two spray stations where three are required for solution acrylic enamels. This greatly reduces the solvent effluent from the spray booths, and saves manpower, space, and overspray. The NADs require less reducing solvent to application viscosity. Less solvent is used in the production, shipping, and inventory of the reducing solvent for NAD enamels. In painting cars with NAD enamels rather than solution enamels, between 4 and 5 pounds less of solvent is released per car painted. Rule 66 has been modified to allow 450 pounds on nonphotochemically reactive solvent to be discharged per hour up to a maximum of 3000 lbs/day from a single emission source. With solution automotive acrylic enamel, this allows painting 32-35 cars/hr. With NAD acrylic enamel, 50-51 cars/hr can be painted before the 450 lbs/hr limit is reached. Before the 3000 lbs/day limit is reached, 334-340 cars can be painted with NAD compared to 216-231 cars with solution acrylic enamel. However, since assembly plants like to maintain 16-20 hr of production at the rate of 45-60 cars/hr, the NAD enamels are not good enough to satisfy Rule 66. But they are a step forward in pollution control, because NADs emit 30-35% less effluent/automobile body.

41653 **APTIC NO. 64068**

Gardenier, Hugh Emory

WET SCRUBBING OF GASES. *(Verfahren zum Nassentstauben von verunreinigten Gasen). Text in German. (Assignee not given.) W. Ger. Pat. Appl. 2,035,683. 7p., April 8, 1971. (5 claims).*

A wet gas scrubber has a nozzle facing in the flow direction to spray wash liquid downstream into a mixing chamber. Before spraying, the liquid is brought to a temperature above its boiling point at the chamber pressure, and to a pressure higher than that corresponding to this boiling point. Preferably the heating is by indirect heat exchange with dirty hot gas. Part of the heated liquid is stored. Part of the wash liquid separated from the gas is cleaned and recycled for indirect heat exchange to the heat exchanger dirty hot gas. The wash liquid in the dirty hot or purified gas stream is heated by after-burning of the gas, with addition of oxygen.

41654 **APTIC NO. 64110**

Glowiak, B. and K Syczewska

CATALYTIC PURIFICATION OF THE ATMOSPHERIC AIR. *(Badania nad katalitycznym oczyszczaniem powietrza atmosferycznego). Air Conserv. (English translation from Polish of: Ochrona Powietrza), 5(4):46-53, 1971. 6 refs. (Presented at the Franco-Polish Symposium, Warsaw, Poland, Oct. 1970.)*

NTIS: TT 72-54022/4

Catalytic oxidation of hydrocarbon vapors was studied with copper/ zinc catalysts. The catalysts are an active agent deposited on a solid support to ensure a low resistance to flow. The catalysts can be sucessfully employed instead of the more expensive platinum catalysts. The best catalyst is the MCA-1 catalyst. In the oxidation of gasoline and kerosene vapors, the optimum temperatures of the catalyst operation are 500 and 540 C, respectively. Since the process is highly exothermic, the operating costs of the equipment may be substantially reduced by suitable converter design using heat exchangers. Attempts to replace conventional catalysts by catalysts deposited on solid supports are valid. Such catalytic converters can be used for handling gaseous emissions such as HC, nitrogen oxides, and carbon monoxide from large commercial plants or motor vehicles.

41655 **APTIC NO. 64114**

Hulewicz, Z.

PARTIAL AEROSOL COLLECTION COEFFICIENTS FOR POROUS BED FILTERS. *(Wspolczynniki czastkowe osadzania aerozoli w filtrach z porowatym wypelnieniem). Air Conserv. (English translation from Polish of: Ochrona Powietrza), 5(3):32-41, 1971. 19 refs.*

NTIS: TT 72-54022/3

The total coefficient of particulate deposition in a porous bed scrubber is discussed. The diffusion model of mass transfer is used to derive the expression for the total coefficient. The coefficient may serve as a general index characterizing both the process kinetics and the operating efficiency of the aerosol collector. For the case of simultaneous mechanisms of collection by inertia, capture, and diffusion, a method is given for the separation of the total coefficient into the partial coefficients.

41656 **APTIC NO. 64059**

Joutsen, Eero Oskari and Pauli Unto Juhani Nyberg

PURIFICATION OF HOT FLUE GASES. *(Vorrichtung zur Reinigung von Rauchgasen u. dgl.). Text in German. (Oy Tampella AB, Tampere (Finland)) W. Ger. Pat. Appl. 2,112,754. 3p., Oct. 7, 1971. (1 claim).*

Gases are cleaned before release to atmosphere or feeding to heat recovery plant. The melt bath chamber in the cleaner is formed by trough-shaped container tanks under a common cover shaped to fit the trough. Gas is fed in from above and passes horizontally through. The melt of ash, soot and other non-combustible components of flue gas is cast to pieces of desired shape and disposed of by digging into the soil, or used as raw material by various industrial branches such as the construction industry. Through the consecutive arrangement of several melt bath chambers the cleaning process is repeated until the desired purity of waste gas is achieved.

41657 **APTIC NO. 64121**

Juda, J. and S. Chrosciel

THE QUALITY COEFFICIENTS OF THE FABRIC AIR FILTERS. *(Wspolczynniki jakosci filtrow powietrza). Air Conserv. (English translation from Polish of: Ochrona Powietrza), 5(4):9-18, 1971.*

NTIS: TT 72-54022/4

Characteristic quantities for fabric filters used in ventilating and air conditioning systems are discussed. The mathematical form of the comparative coefficients and of quality coefficients for this type of filter is proposed. The coefficients derived are discussed, and the values of characteristic quantities are compared for ten fabric filters. The efficiency and resistance of the filters are related to dust loading. Performance coefficients are discussed; it is difficult to determine performance because it is a rather involved task, and the performance coefficients determined cannot be regarded as conclusive or entirely satisfactory.

41658 **APTIC NO. 63411**

Lapointe, Alex J.

QUALITY COATINGS DERIVED FROM OVERSPRAY SOLID WASTES. *Preprint, Chemical Coaters Assoc., 9p., 1971. (Presented at the International Anti-Pollution Coating Seminar, 1st, Chicago, Ill., Dec. 12-14, 1971.)*

The vapors from sprayed paint can pollute the air, and spray booth sludges can cause solid waste disposal problems. Many quality automotive and industrial coatings are being reclaimed from paint spray booth sludges. Such reconstituted paints meet all the chemical, physical, and performance requirements of the original coatings at a very substantial material cost savings. Furthermore, the expense of solid waste disposal is eliminated. The burial of these sludges would constitute land pollution. It would be possible to dispose of paint sludges by burning, but this could cause air pollution. Hence, for both economic and ecological reasons, increasing consideration is being given to the business of paint reclamation. (Author abstract modified)

41659 **APTIC NO. 64112**

Marcinkowski, S. and S. Babinski

FLY ASH FOR THE MANUFACTURE OF A HYDRAULIC LIME-CEMENT. *(Zastosowanie popiolow lotnych do produkcji spoiwa pylowo-wapienno- gipsowego). Air Conserv. (English translation from Polish of: Ochrona Powietrza), 5(4):34-40, 1971. 8 refs.*

NTIS: TT 72-54022/4

Quantities of fly ash and slag produced by a Polish power plant in 1970 of 27,600 and 6900 are expected to increase to 127,520 and 31,880 tons, respectively by 1975. Similarly, the dyanamic growth of power production will increase fly ash and slag production from other power plants. This will increase the need for a method of waste disposal which will reduce pollution. A partial utilization of fly ash for building needs may be achieved by the manufacture of a fly ash-based hydraulic lime-cement. Utilization of fly ash as a hydraulic addition in the manufacture of cements requires knowledge of the pozzolanic activity of the fly ash. Various coal combustion parameters may affect the pozzolanic activity. The pozzolanic activity of fly ash determines, in general terms, their ability for chemical binding. Since fly ash is not binding by itself, but together with an initiator in its presence, this material is capable of forming hydrates, the pozzolanic activity is the ability to form hydrates. Fly ash is hydraulic if its particles react with lime to yield calcium silicates, hydrated aluminates, and calcium silicate hydrates. Thus, before a decision is made to use fly ash for cement manufacture, the pozzolanic activity of the fly ash in question should be determined.

41660 **APTIC NO. 63414**

Miller, Emery P.

ANTI-POLLUTION ASPECTS OF POWDER COATING PROCESSES. *Preprint, Chemical Coaters Assoc., 6p., 1971. (Presented at the International Anti-Pollution Coating Seminar, 1st Chicago, Ill., Dec. 12-14, 1971.)*

During surface coating operations, it is possible that some of the spray material can escape. After the coating is applied, some solvents can leave the film by evaporation. These two sources of air pollution can be eliminated by the powder coating method which is discussed. In liquid coating systems, of 300 gal of material used, only 135 gal is applied to the parts, the rest is oversprayed. The excess and the 180 gal of solvent material and 66 gal of solids material emitted very 8 hr must be collected by water wash booths. Afterburners can reduce the solvent effluent, and electrostatic liquid spraying can further reduce emissions. In powder coating, the resin material is prepared in the form of a dry dust-like powder. It is deposited on the surface to be coated and is fused there to form the desired coating. Several powder methods are discussed. The powder method has much less powder oversprayed. Excess powder can be removed by ventilation and collection. By reusing reclaimed powder, an overall efficiency of 99% can be achieved. Since there are no solvents, air contamination is low.

41661 **APTIC NO. 63416**

Moorman, Earl F.

ELECTROSTATIC POWDER COATING OF TRACTORS IN JAPAN. *Preprint, Chemical Coaters Assoc., 7p., 1971. (Presented at the International Anti-Pollution Coating Seminar, 1st, Chicago, Ill., Dec. 12-14, 1971.)*

A process of electrostatic powder coating of tractors in Japan is discussed. The powder particles are given an electrostatic charge. The charged powder is attracted to the parts to be coated and adheres electrically to their surface. As the film thickness builds up, additional charged powder particles then migrate to thinner areas which results in a uniform film thickness. The fluidized bed method of powder coating was combined with the electrostatic charge process. This process has the advantages of no fire hazard from flammable solvents, thick films are possible with a single cost, the film has excellent chemical resistance and mechanical properties, and the material loss is negligible. The over-spray can be collected and reused. The disadvantages of this method, types of plastic powders, uses of the coating, and the method of spraying are described.

41662 **APTIC NO. 64143**

Poloczek, J. and A. Zembok

A POSSIBILITY OF SUPPLYING POWER TO THE ELECTROFILTERS FOR POWER BOILERS BY MEANS OF ELECTRIC IMPULSES. *(Mozliwosc impulsowego zasilania electrycznego elektrofiltrow dla kotlow energetycznych). Air Conserv. (English translation from Polish of: Ochrona Powietrza), 5(6):1-5, 1971. (Presented at the Polish-French Symposium, Warsaw, Poland, Oct. 1970.)*

NTIS: TT 72-54022/6

Reasons for reduction of the efficiency of operation of the electrofilters which remove dust from flue gases from boilers fired with low-calorific bituminous coal are discussed. Possibilities of improving electrofilter efficiency by impulse power are discussed. The conditions which should be fulfilled by this system of power supply are given. Analysis of pulsed power supply is based on this fundamental formula for determining the collection efficiency of an electrofilter: collection efficiency equals 1 - e to the (effective settling surface of the collecting electrode/divided by the rate of gas flow through the electrofilter) times the settling velocity of particles in the electric field power.

41663 **APTIC NO. 64128**

Ryszka, E.

FORMATION OF THE PROFILE OF GAS VELOCITY AND DUST CONCENTRATION OF GAS IN PIPES. *(Ksztaltowanie profilu predkosci i stezenia gazu w przewodach). Air Conserv. (English translation from Polish of: Ochrona Powietrza), 5(6):42-57, 1971. 10 refs. (Presented at the Polish-French Symposium, Warsaw, Poland, Oct. 1970.)*

NTIS: TT 72-54022/6

The problem of the distribution of gas velocity and dust concentration of a dust-laden gas stream in pipes is discussed. Profiles of gas velocity and dust concentration in the industrial pipes are, as a rule, nonstabilized. Experiments were conducted on the formation of gas velocity, and dust concentration profiles were analyzed by means of venturi tubes. Due to the installation of venturi tubes, the profiles of gas velocity and dust concentration can be formed and compared by means of adequate criteria. It is possible to raise the concentration of dust in the direction of the pipe axis by means of the venturi tubes and to use phenomenon for dust removal from gases. The profiles can also be used for automatic measurements of dust concentration.

41664 **APTIC NO. 64144**

Svidrnoch, L. and O. Poruba

RESULTS OF INVESTIGATION ON REDUCTION OF SO2 EMISSION TO THE ATMOSPHERE AT THE WITKOWICE STEEL WORKS. *(Wyniki badan nad ograniczeniem emisji SO2 do atmosfery w hucie Witkowice). Air Conserv. (English translation from Polish of: Ochrona Powietrza), 5(6):11-22, 1971.*

NTIS: TT 72-54022/6

Experiments were conducted with a venturi washer for desulfurization of the combustion gases from an oil-fired boiler. The fuel oil contained 2.6% sulfur. Although the adequately low temperatures of water were not maintained, the efficiency of desulfurization was 60-70%. Tests on the desulfurization of combustion gases from a tandem furnace were also carried out. The behavior of construction materials in the atmosphere of gases containing SO2 was also studied. The materials studied included various steels which are used to construct venturi scrubbers. Desulfurization costs are given.

41665 **APTIC NO. 64117**

Szwed, H., J. Wrobel, and J. Gega

INVESTIGATION ON NEUTRALIZATION OF SULFUR COMPOUNDS IN COMBUSTION GASES DISCHARGED TO THE ATMOSPHERE. *(Badania nad neutralizacja zwiazkow siarki w spalinach usuwanych do atmosfery). Air Conserv. (English translation from Polish of: Ochrona Powietrza), 5(5):42-51, 1971. 6 refs. (Presented at the Polish-French Symposium, Warsaw, Oct. 1970.)*

NTIS: TT 72-54022/5

Sulfur removal from waste gases produced during agglomeration processes in the metallurgical industry was studied using scrubbing with waste dolomite-lime dusts and hydrated lime in a single layer fluidized reactor. The best results were obtained with the temperature of combustion gases below 100 C, relative humidity above 80%, and a hydrated lime of a grain size of 0.08-0.6 mm.

41666 **APTIC NO. 65920**

Tarat, E. Y., Y. G. Fialkov, Y. A. Golovachevskiy, A. P. Pichukov, V. G. Shkodina, and A. P. Nikitina

CHLORINE ABSORPTION BY A SODA SOLUTION IN A HOLLOW HIGH-SPEED SCRUBBER. *(English translation from Russian of: Khim. Prom.) Sov. Chem. Ind., no. 1:37-39, Jan. 1971. 3 refs.*

Chlorine absorption by soda solutions in an industrial hollow high speed scrubber was investigated relative to the sanitary purification of the gases of magnesium production. The experiments were conducted at gas flow rates of 45, 54, and 63 thousand cu m/hr. The rate of chlorine absorption was directly proportional to its partial pressure in the gas, and the absorption rate coefficient does not depend on the soda concentration when its amount in solution is more than 20 g/l. Such dependences are characteristic of absorption processes whose rate is limited by gas-phase resistance. The degree of gas purification is 84%. To reach higher degrees of recovery (95% and higher), gas purification should be conducted in two stages. Force pumps should be constructed out of titanium in order to guarantee prolonged operation in the corrosive medium.

41667 **APTIC NO. 63415**

Waid, Donald E.

THERMAL INCINERATION FOR SOLVENT FUME CONTROL. *Preprint, Chemical Coaters Assoc., 10p., 1971. (Presented at the International Anti-Pollution Coating Seminar, 1st, Chicago, Ill., Dec. 12-14, 1971.)*

Thermal incineration for solvent fume control is described including definitions, restrictions on the use of the thermal process, development of the thermal process, oxidation of organic or carbon-bearing compounds for air pollution control, present status of thermal incineration (acceptance, advantages, and variations), laboratory tests, advantages, methods of fuel economy, heat recovery by heat exchangers and blenders, reduction of effluent flow, use of effluent oxygen for combustion, and the most efficient possible design and operation. In the laboratory tests, efficiency of reduction of hydrocarbons and carbon monoxide, temperature, and ability to meet Rule 66 were measured for paint drying and wire enameling ovens. Direct gas flame thermal incineration will control metal coating oven exhaust or all organic air pollutants to almost any desired limit. The very simple control of temperature allows the required amount of pollutant control. No other control is required. This flexible method can be changed simply as the code requirements change by changing the operating temperature. The same performance is maintained day-in and day-out. In many cases, oxygen from the effluent can be utilized for combustion, reducing fuel consumption. When the heat is reused, very little, if any, additional fuel is required for incineration. Quite frequently, additional heat from the combustibles in the effluent, not previously recovered, can be utilized some place in the industrial plant. This helps reduce actual operating costs of the incinerator and overall operating costs of the plant. (Author summary modified)

41668 **APTIC NO. 64076**

Wiesenthal, Peter von, Robert G. Buchholz, and Carmela J. Iacona

CATALYTIC CRACKING GAS CERAMIC BURNER. *(Keramische Verbrennungseinrichtung fuer ein Brenngas niedrigen Heizwertes). Text in German. (Selas Corp. of America, Dresher, Pa.) W. Ger. Pat. Appl. 1,501,960. 4p., Dec. 30, 1971. (3 claims).*

The system is used for waste gases of hydrocarbon cracking which exhibit a low calorific value, and the feed channels as well as the air ducts feature cross sections progressively increased with the distance from the end wall. The baffles are located in the downstream end of the furnace section, while the air duct of each feed channel is located behind the former in the main flow direction and at an angle with respect to the baffle. The design ensures a longer residence time for the gases in the furnace.

41669 **APTIC NO. 63436**

AND SOMEDAY, THE INTERNAL COMBUSTION ENGINES WILL HAVE TO BE RELINQUISHED. *(...et si l on devait un jour renoncer au moteur d explosion). Text in French. Pet. Prog., no. 88:11-15, 1971.*

Possible and potential alternatives to the internal combustion engine that some day will have to be relinquished due to its inability to meet environmental standards and to the depletion of the petroleum resources are discussed. Stirling engines have the advantages of reduced pollution, and the optional use of different kinds of fuels, but they have low efficiency, on the order of 20%. Gas turbines are efficient only for engine powers over 400 HP and for high speeds. The combination of electric motor with gas turbines appears most promising in hybrid drives. Fuel cells as an energy source need a great amount of development before they will be suited for automobiles. Thus, battery- powered vehicles are most likely to succeed conventional cars.

41670 **APTIC NO. 64209**

(Inventor not given.)

DESULPHURISING COMBUSTION GAS. *(Entschwefelungsmittel fuer Rauchgase). Text in German. (Ito, Kuninori, Nagoya, Aichi (Japan) W. Ger. Pat. Appl. 2,159,845. 2p., June 15, 1971. (1 claim).*

A desulfurization agent is produced by mixing 1 pt of a mixture of 0.5 pts of nickel acetate and 0.5 pts of copper carbonate with 1 pt of iron hydroxide, adding active carbon, granulating and heating to 300 to 1050 C in an oven with further addition of a gas consisting of 10-12% carbon monoxide, 8i10% carbon dioxide 5-7% oxygen and the remainder nitrogen. The desulfurizing agent is acid-proof, durable, and highly efficient even at flue gas temperatures as high as 700 C. The desulfurizing agent can be easily regenerated by washing with water and subsequent drying.

41671 **APTIC NO. 65923**

FLUORINE RECOVERY BY THE PHOSPHATE FERTILIZER INDUSTRY PART II COMMERCIALLY AVAILABLE PROCESSES FOR RECOVERING FLUORIDES ETC. *Phosphorus Potassium, no. 15:21-24, 28-29, July/Aug. 1971 4 refs.*

Commercially available processes for the emission control of fluorine compounds in phosphate processing are discussed. In the past fluorine chemicals from phosphate plant off gases were scrubbed and disposed of, usually as fluosilicic acid. Today fluosilicic acid is the starting material for the production of a large range of fluorine compounds. The almost inexhaustible source of supply offered by recovery from phosphate processing has provided incentive for the development of a number of commercially feasible systems for the manufacture of materials as fluosilicates, fluorides, synthetic cryolite, and hydrofluoric acid from the fluorine effluent from phosphatic fertilizer production.

1970

41672 **APTIC NO. 63519**

Castro, Raul Fernandez de

PURIFICATION OF WASTE GAS, ESPECIALLY EXHAUST GASES FROM INTERNAL COMBUSTION ENGINES. *(Verfahren zum Beseitigen schaedlicher Bestandteile in einem umschlossenen Rauchgasstrom). Text in German. (Castro (R. F. de) Enterprises, Inc., Olean, N. Y.) W. Ger. Pat. Appl. 2,043,137. 6p., Aug. 31, 1970. 2 refs. (5 claims).*

A method for removing harmful components from a waste gas, especially exhaust fumes in the internal combustion engine, is described. It comprises burning methyl or ethyl alcohol in the waste gas and is a modification in which monohydric alcohols are used. An oxidant, for example, oxygen or hydrogen peroxide may be added. The alcohol as an aqueous solution and the oxidant are preferably atomized into the waste gas. Preferably, alcohol solutions contain less than 90% (especially less than 50%) alcohol.

41673 **APTIC NO. 63449**

Coughlin, R. W., J. R. Polek, and M. Hartmen

OXIDATION OF SULFUR DIOXIDE BY GAS SCRUBBING IN A COLUMN PACKED WITH CARBON. *Preprint, American Inst. of Chemical Engineers, New York, 31p., 1970. 9 refs. (Presented at the American Institute of Chemical Engineers, Annual Meeting, 63rd, Chicago, Ill., Nov. 29-Dec. 3, 1970, Paper 3f.)*

Several methods have been developed for the removal of sulfur dioxide from flue gas by oxidation on absorbents such as carbon. The lack of practical and fundamental data describing the simultaneous interactions of water, SO2, oxygen, and carbon, in such systems motivated an experimental study on the sorption and chemical reaction of SO2 from an oxygen-bearing gas flowing countercurrent to water in a column packed with carbon. The mathematical model and experimental results obtained in stirred tank and column reactors are discussed. The effects of catalyst particles, temperature, SO2, and O2 on the reaction are discussed. The SO2 breakthrough time depended on the liquid-gas flow rate ratio and on the quantity of oxygen present in the gas phase. Additionally, the pH of the liquid which contacts the carbon may be an important factor. The presence of water in small quantities enhanced the oxidation reaction, but the presence of excess water reduced the rate of SO2 oxidation, probably because of the additional resistance to mass transfer introduced by more completely wetting the catalyst particles. An optimum O2 to SO2 concentration ratio in the gas phase was not established; presently it appears that the greater the proportion of the oxygen present, the longer the time to SO2 breakthrough. This may be due in part to the low solubility of O2 in water compared with SO2. (Author conclusions modified)

41674 **APTIC NO. 63634**

Flynn, Charles Sidney

REMOVING NOXIOUS FUMES FROM WASTE DIGESTER GASES. *(Vorrichtung und Verfahren zur Reinigung von Luft). Text in German. (Assignee not given.) W. Ger. Pat. 1,936,785. 22p., Jan. 22, 1970. 1 ref. (Appl. July 19, 1969, 6 claims).*

Waste gases from Kraft cellulose plants are drawn off and pressed under pressure into a collector equipped with openings or nozzles. The waste gases leave ghe collector through those openings in the form of fine flows with speeds exceeding that of flame propagation. They are ignited by extremely hot combustion gases supplied by one or more burners of special design. A characteristic of each burner is a square or rectangular casing with one open side which is sealed by a coarse wire mesh; by a thin (20 to 40 thousandths of a mm) layer of heat-resistant fiber material of clay and silica (mixing ratio 50 to 50) distributing the gas; and by a relatively fine-meshed supporting mesh which is followed by a coarse supporting mesh. Through the afterburning process, odorous components in waste gases from the Kraft process are eliminated; methyl mercaptan is reduced from 5340 ppm to 160 ppm, dimethyl sulfide from 9030 to 398 ppm, isopropyl mercaptan from 8840 to 162 ppm, dimethyl disulfide from 1790 to 648 ppm, and dipropyl sulfide from 5050 ppm to an undetectable amount.

41675 **APTIC NO. 63456**

Happel, J., H. Odanaka, and P. Rosche

TRACER STUDIES OF THE CATALYTIC OXIDATION OF SULFUR DIOXIDE. *Preprint, American Inst. of Chemical Engineers, New York, 20p., 1970. 11 refs. (Presented at the American Institute of Chemical Engineers, Annual Meeting, 63rd, Chicago, Ill., Nov. 29-Dec. 3, 1970, Paper 22c.)*

Thy mechanism of the oxidation of sulfur dioxide over a vanadium pentoxide catalyst was investigated at 460 and 480 C in an all glass, essentially gradientless reactor. The findings obtained using radioactive sulfur(35) as a tracer indicate that steps involving sulfur account for some of the rate controlling elementary reactions, but that oxygen chemisorption also exerts a considerable effect on the overall rate. These findings may be of interest in seeking new catalyst formulations for the conversion of gases which are dilute in SO2. This could be important in air pollution control applications. (Author abstract modified)

41676 **APTIC NO. 63433**

Mehta, K. C. and M. M. Sharma

MASS TRANSFER IN SPRAY COLUMNS. *Brit. Chem. Eng., 15(11): 1440-1444, Nov. 1970. 8 refs.*

The effect of the type of nozzle, gas and liquid flow rates, the height of the column, and physical properties of the liquid on the performance of spray columns of 7.9 to 38.5 cm i.d. was investigated. The theory of absorption accompanied by pseudo nth-order (n equals 0.1) reaction was used to obtain values of effective interfacial area. The effect of solids formed in situ on the effective interfacila was studied. The effect of gas velocity on the gas side mass transfer coefficient and the interfacila area does not depend strongly on the droplet size, at least in the range of gas velocity investigated. (Author abstract modified)

41677 **APTIC NO. 64225**

Picchelauri, Yevgeniy N., Nikolay I. Kobotsev, Yekaterina S. Mayevskaya, Yuriy M. Yemel yanov, Ivan I. Galanin, Andronik P. Amar yan, and Mikhail F. Yemel yanov

EXTREME PURIFICATION OF EXHAUST GASES TO REMOVE OXIDES OF NITROGEN. *W. Ger. Pat. 1,925,871, p. 1-12, 1970. Translated from German. Joint Publications Research Services, Washington, D. C., Air Force Systems Command, Proj. G101, Foreign Technology Division-HC-23-0380-72, 11p., May 24, 1972.*

NTIS, DDC: AD-748884

A process for the extreme purification of gases containing nitrogen oxides is described. The original gas is oxidized with excess ozone, with the formation of nitric anhydride which is absorbed in water. The excess O3 completely oxidizes the nitrous gases and prevents the decomposition of N2O5 before its hydration to nitric acid. The amount of excess O3 is determined by the stability of the technological flow of the nitrous gases and their concentrations and the conditions of decomposition of N2O5. The excess O3 usually does not exceed 20%. Nitric oxide and nitrogen dioxide are completely absent when the gas flows from the absorber. The bound nitrogen is exclusively in the form of HNO3 vapors, in a concentration of the order of magnitude of 1 ppm in terms of N2O5. Some O3 remains in the exhaust gas. This process attains a greater purification than similar processes. The NOx are reduced to below the safety standard and 99% of them can be recovered as nearly pure HNO3. Further purification can be obtained through catalytic oxidation.

1969

41678 **APTIC NO. 64269**

Bratzler, Karl and Alexander Doerges

DRYING AND PURIFICATION OF GAS SUPPLIES. *(Verfahren zum Trocknen und Reinigen von Versorgungsgasen). Text in German. (Metallgesellschaft AG, Frankfurt (Germany)) W. Ger. Pat. Appl. 1,494,803. 4p., July 1969. (2 claims).*

In the known process of drying town or natural gas with air and/or tri-ethylene glycol, followed by washing out hydrogen sulfide with a high-boiling solvent, a partial stream of solvent is drawn off and used to pre-wash the gas before it enters the main wash. The solvent is wholly or partly regenerated by distillation under reduced pressure of more than 300 torr and returned to the main wash cycle. The partial stream is more than 5%, preferably 1% of the solvent in the main wash cycle. Suitable solvents are dimethyl formamide, tetra alkyl ureas, N-methyl pyrrolidone, and alkylene carbonate esters. Corrosion of the main washing plant and deposits of iron sulfide are prevented. Iron compounds, higher boiling decomposition products of the solvent, and glycols carried over from the drying stage collect in the sump of the vacuum distillation column from which they are removed.

1965

41679 **APTIC NO. 64193**

Bourelly, T.

THE EFFICIENCY OF SOOT CAPTURE DEVICES. *(L efficacite des capte-suie). Text in French. Cahiers Centre Sci. Tech. Batiment, no. 74:1-11, June 1965.*

The efficiency of different types of soot traps was studied in situ. Dry soot traps used in firing equipment which are not blown or which are of weak or medium power were ineffective with a soot separation efficiency of 2.8-6%. West soot traps in the same type of firing equipment were more effective but more susceptible to corrosion. Dust separators in high-power blown firing equipment were highly effective. The soot traps in themselves should be maintained; however, the installation of soot traps does not obviate the necessity of the proper maintenance and adjustment of the burners.

41680 **APTIC NO. 64092**

Walthall, J. H.

COMPACT SCRUBBER LESSENS DUCTWORK. *Chem. Process. (Chicago), vol. 28:93, Aug. 1965.*

A fume control system was designed to draw air from a superphosphate-curing den and to scrub out varying amounts of fluoride which would minimize costly ductwork use in controlling the corrosive fluorides. The fluoride concentration ranged from 0 to 0.001 lbs/cu ft during a 24-hour cycle of operation. The volume handled was 12,500 cu ft/min of gas. A jet-venturi flame scrubber operating on a principle similar to a steam-jet ejector was selected as the control method. It used a water or aqueous solution and a spray nozzle. With a concentration of 0.001 lbs/cu ft fluoride, when the fluorine content of the scrubber liquor is limited to about 3000 ppm, removal efficiency was approximately 98%.

1962

41681 **APTIC NO. 63510**

Albrecht, J.

REGENERABLE FIBROUS MATERIAL FOR PRE-STAGE FILTRATION. *(Regenerationsfaehiges faseriges Vorfiltermaterial). Text in German. Czechoslovak Academy of Sciences, Aerosols, Phys. Chem. Appl., Proc. Nat. Conf. 1st, Liblice, Czechoslovakia, 1962, p. 681-691. (Oct. 8-13.)*

New regenerable synthetic filter material for pre-stage aerosol filtration is described. The layered, needle-punched filter material is made of tesil (perlon) by using polyvinyl acetate as binding agent. The filter materials conmmercialized under the trade name Nefi I, II, and III, are 25 mm in thickness, have surface weights of 350, 500, and 450 g/sq m and fiber diameters of 40-60, 40-60, and 25-35 micron, respectively. Their dust and aerosol separation efficiency is 20 to 40% higher than that of conventional pre-stage filter materials, such as wire nettings. Nefi filter materials are used dry, are possibly polarized, and preferably sprayed with oil when exposed to vibrations, such as vehicles. The filters can be easily regenerate by knocking, vacuuming, or rinsing. Increase of the pressure loss by only 5% after five regeneration cycles was determined.

41682 **APTIC NO. 63512**

Fiser, V.

PRECIPITATORS FOR AIR CLEANING. *(Elektrofilter fuer Luftreinigung). Text in German. Czechoslovak Academy of Sciences, Aerosols, Phys. Chem. Appl., Proc. Nat. Conf., Liblice, Czechoslovakia, 1962, p. 699-702. 2 refs. (Oct. 8-13.)*

The increase of the aerosol separation efficiency of different filter materials by the application of electric forces prior to or during filtration was demonstrated in laboratory experiments. The application of an electrostatic field of 10 kV/cm in the flow direction of a potassium dichromate aerosol with a particle size of 0.8 micron through a basalt fiber filter resulted in an increase of the aerosol separation efficiency from 55.5% without electrostatic field to 99.98% with electrostatic field. Polarization of the aerosol and of the filter material considerably increased the separation efficiency of polvinyl chloride chips and foam separators for the micron and submicron range. A new filter with prestage ionization for medium separation requirements, such as for air conditioning, has been developed.

41683 **APTIC NO. 63518**

Machala, O.

ELECTROSTATIC PRECIPITATOR AND ITS APPLICATION AND CATCHING BIOLOGICAL AEROSOL. *Czechoslovak Academy of Sciences, Aerosols, Phys. Chem. Appl., Proc. Nat. Conf., 1st, Liblice, Czechoslovakia, 1962, p. 907-915. 2 refs. (Oct. 8-13.)*

The construction of an electrostatic precipitator for filtration and detection of biological aerosol is discussed. Defects occurring in the evaluation of the caught aerosol were avoided. The quantity of ozone was fixed and its effect on the microbial aerosol was studied. Three electrodes, rather than one, are used, originating three times as much ozone from the corona. A method of determining ozone is described. The measured concentrations of ozone are the total values of the ozone developed on the corona, which means that the concentrations of ozone in the precipitator space are low. Moreover, the microbial aerosol was exposed to the direct effect of ozone for only 5 min, when the sampling took place. The aim of these measurements was to get an idea of how large the concentrations of ozone actually originate. If the electrostatic precipitator is suitably adjusted, this method is useful for the detection of microbial aerosol from the atmosphere. By appropriate arrangement of the electrodes, adjustment of the voltage and the amount flowing through a 100% efficiency has been achieved, as well as a low ozone concentration having little effect on the vitality of microbial aerosol.

41684 **APTIC NO. 63479**

Pauthenier, M.

MONO- AND DIIONIZED ELECTRICAL FIELDS AND THE MECHANICS OF DISPERSED MATTER. APPLICATION TO THE ELECTRICAL PURIFICATION OF GASES. *(Champs electriques mono et bi-ionises et mecanique de la matiere dispersee. Application a la purification electrique des gas). Text in French. Czechoslovak Academy of Sciences, Aerosols, Phys. Chem. Appl., Proc. Nat. Conf., 1st. Liblice, Czechoslovakia, 1962, p. 53-58. 3 refs. (Oct. 8-13.)*

A theoretical study of monoionized and diionized electrical fields in electrostatic precipitators used for the separation of particles with high electric resistivity, such as occurring in power plant flue gases and cement works, and of their effects on the dust efficiency is described. The discharge, and consequently the dust separation, are hindered by the gradually increasing dust deposits on the electrode with the electrical field remaining monoionized. Then, with increasing voltage, the current exceeds the normal value, and the electrical field becomes diionized due to counteremission through the separated dust layer, a phenomena that also results in reduced separation efficiency.

41685 **APTIC NO. 63494**

Radushkevich, L. V. and V. A. Kolganov

STUDY OF COLLECTION OF HIGHLY DISPERSE AEROSOLS FROM A GAS STREAM ULTRA-THIN CYLINDERS. *Czechoslovak Academy of Sciences, Aerosols, Phys, Chem. Appl., Proc. Nat. Conf., 1st, Liblice, Czechoslovakia, 1962, p. 247-256. 11 refs. (Oct. 8-13.)*

The problem of aerosol collection from a gas stream on large obstacles using ultra - thin fibers for filtration is considered. A theory is presented of diffuse settling of aerosols on ultra-thin fibers, and an experiment described with the aim of obtaining aerosols of simple particle shape, non-volatile, and resistant to the influence of electrons. The primary purpose consisted of investigating the dependence of the efficiency n on the particle size and on the velocity within the widest possible range of particle sizes. The problem is solved using polydisperse aerosols with a known distribution of particle size, which permit settling experiments to be undertaken under identical conditions. The experiments were carried out with tungstic oxide, polystyrene, and methylene blue aerososl. The settling efficiency of all three aerosols is different for a given particle size; the curve of the relationship between n and d is in principle the same for all three aerosols. The monotonous decrease of n with growing particle size is found for all aerosols and both velocities. An increase of n within the entire range of particle sizes and for all velocities was found. The settling efficiency for all aerosols depends on the flow velocity. The n diminishes with rising velocity in the entire range of particle sizes. An interpretation of the results is based on the known causes of the capture of aerosol from a gas flow on obstacles, in particular on cylinders. It is possible to connect the causes of the settling with diffusion and direct interception. Diffuse settling plays a predominant role for small particles on ultra thin cylinders. The continous decrease of n with rising d and the drop of n with rising velocity is probably due to the reduction of the diffusion velocity.

41686 **APTIC NO. 63508**

Tomaides, M.

THE STATE OF THE AIR OF THE DEVELOPMENT AND PRODUCTION OF AIR FILTERS IN CZECHOSLOVAKIA. *(Der gegenwaertige Stand der Entwicklun und Erzeugung tschechischer LuftFilter). Text in German. Czechoslovak Academy of Sciences, Aerosols, Phys, Chem. Appl., Proc. Nat. Conf., 1st, Liblice, Czechoslovakia, 1962, p. 645-655. (Oct. 8-13.)*

New air filter products currently manufactured in Czechoslovakia for ventilation air cleaning and for industrial dust separation are described. Stretchable metal filter cells are especially suited for the separation of dust from ventilation air, even at high temperatures, at efficiencies of about 50%. Polyvinyl chloride chip filter cells have an efficiency of 60% and can be used at a maximum temperature of 60 C. Silon filters have efficiencies of 60% and up to 98%, the latter when wetted with oil. Paper layer filters are efficient in the separation of fine dust as small as 0.3 micron, with efficiencies ranging from 97 to 99.98%. Roll-o-matic type filters with a Nefi filter layer separate 50 to 60% of dust at a pressure loss of 16 mm water column and are designed for capacities of up to 20,000 cu m/hr. Continuously sprayed filters are suited for continuous operation with increased separation efficiencies reaching 95%. The EON 8 model electrostatic precipitator with a separate ionization chamber is used for the separation of dust in a size range of 0.01-40 micron at an efficiency of 90%.

41687 **APTIC NO. 63511**

Tuma, J.

METHODS OF MEASURING THE COLLECTING EFFICIENCY. *Czechoslovak Academy of Sciences, Aerosols, Phys. Chem. Appl., Proc. Nat. Conf., 1st, Liblice, Czechoslovakia, 1962, p. 693-698. (Oct. 8-13.)*

An analysis of some of the testing methods of dust separators is presented, with a summary of the factors which influence the relation of test to actual processes. The tests measure the workin properties of the separator in question, inspect the construction, and measure the collecting efficiency. The principal parts of any method to be considered are: the testing equipment must allow the temperature and humidity of the carrying gas to be reached and maintained; the test aerosol is defined by the carrying gas, the particles and their ratio, i.e., their concentration; and the detecting method must give a true picture of the aerosol in front of and behind the separator. Three testing methods are mentioned, including one using an aerosol obtained by evaporation of a dispersed solution of potassium dichromate, another using artificially prepared dust fed into the equipment and indirect detecting means, and a third using direct optical methods of detecting.

1956

41688 **APTIC NO. 64210**

Dennis, Richard, Leslie Silverman, Charles E. Billings, August T. Rossano, Jr., Edward Connors, Jr., Richard D. Coleman, David M. Anderson, William R. Samples, and Philip Drinker

AIR CLEANING STUDIES. PROGRESS REPORT FOR JULY 1, 1953 TO JUNE 30, 1954. *Harvard Univ., Boston, Mass., Air Cleaning Lab., Atomic Energy Commission Contract AT(30-1)841, Rept. NYO-4608, 59p., Jan. 15, 1956. 13 refs.*

An air and gas cleaning project to study air and gas cleaning devices and methods for their testing and evaluation, training and education of personnel, collection and correlation of information on air and gas cleaning, and consultation services is described. Experiments conducted as part of the project are discussed. Isokinetic stack sampling probes and stain efficiency measurements for rating high velocity roughing filters were tested. A commercial electrostatic dust collector's performance was tested and was effective as a precleaner for laboratory air where operating conditions require removal of 90-95% of the entering dust load. As part of the project, research and development studies were conducted on air cleaning methods and equipment including pyramid screens, electrostatically charged aerosol filters, deep bed fiber filters, and cotton fibers. Electrostatic mechanisms in fiber filtration of aerosols and mechanical electrostatic charging of fabrics for air filters are discussed. Blast damage to air cleaners was studied during filter tests. The program's consulting and training services to the Atomic Energy Commission are reviewed. Research in progress, future plans, facilities, and personnel are mentioned.

1929

41689 **APTIC NO. 64154**

(Inventor not given.)

METHOD AND APPARATUS FOR SUPPRESSING MALODOROUS GASES PRODUCED IN THE MANUFACTURE OF CELLULOSE BY THE SULFATE OR SODA PROCESS. *(Verfahren und Vorrichtung zur Beseitigung der bei der Sulfat- und Natroncellulosegewinnung gebildeten uebelriechenden Gase). Text in German. (Bror Natanael Segerfelt Poetschmuehl, Boehmisch Krumau (Czechoslovakia)) Ger. Pat. 549,783. 5p., Dec. 22, 1929. (Application date not given, 5 claims).*

A method for the elimination of odorous gases emitted from the manufacture of cellulose by the sulfate or soda process is characterized by cooling the gases to the dew point or by saturation with water. They are then treated with hydrocarbons dissolved or emulsified in aqueous alkaline solution. The hydrocarbons are terpenes, camphor, or their derivatives or additives. The gases are treated in a vacuum or at a slight overpressure at temperatures between 20 and 120 C. They are initially cleaned with liquids of high viscosity. The equipment comprises a funnel-shaped container which is separated into two chambers by a wall. The two chambers are combined at the bottom of the container. They widen in flow direction of the gas. One chamber posses an inlet and nozzles at the top the other one or more outlets and nozzles.

MEASUREMENT METHODS

1974

41690 **APTIC NO. 64332**

Akiyama, Shigeyuki and Tsugukage Oshima

RETENTION OF ACCURACY AND MAINTENANCE OF THE NON-DISPERSIVE INFRARED SO2 ANALYZER. *(NDIRho ni yoru SO2 bunsekikei no seido ijito mentenansu ni tsuite). Text in Japanese. Keiryo Kanri Keisoku Keiso (J. Instrum. Control Assoc., Japan), 23(4):3-6, 1974. 5 refs.*

The non-dispersive infrared sulfur dioxide analyzer is characterized by high selectivity, determination of SO2 concentration in the presence of other gases, quick response, instantaneous measurement, elimination of chemical pretreatment, high sensitivity, reproducibility, and simple maintenance. For the continuous measurement of SO2 in stack exhaust, the hot humid, and dusty sample gas has to be cleaned and dried using a pretreatment apparatus. The specificstions and flow diagram of an ESDA-200 SO2 analyzer are given and the operational procdures are described. To maintain accuracy, the instrument has to be adjusted periodically using reliable standard gas, and the leak, moisture, and adsorption in the sampling system and pretreatment apparatus are to be checked periodically. For the selection of the sampling location, various conditions such as the composition of sample gas, presence of corrosive gases like hydrogen chloride, hydrogen fluoride, and sulfur trioxide mist, temperature, pressure, particulate concentration and accessibility of the location for maintenance are to be taken into account. The lists for daily maintenance, periodical maintenance, and check points in the case of trouble are given.

41691 **APTIC NO. 63960**

Armstrong, B. S. and J. G. Beese

MONITORING THE FALLOUT OF GRIT AND DUST EMITTED BY INDUSTRIAL SOURCES. *Clean Air, 4(14):18-21, Summer 1974. 6 refs.*

A method of monitoring grit and dust fallout from industrial sources is proposed based on a computer contour plot of test data collected from sample points arrayed around the industrial plant in an orderly geometric manner. From the contour plot, a nondirectional fallout index can be established which can be used to check the pollution output of the plant being monitoring. Such a monitoring system will help industrialists in their efforts to improve standards of production, maintenance, and design. (Author abstract modified)

41692 **APTIC NO. 65811**

Baker, Bertsil B., Jr. and D. Peter Carlson

MEASUREMENT OF TRACE AMOUNTS OF HEXAFLUOROACETONE IN AIR BY INFRARED SPECTROMETRY, AFTER CONVERSION TO FLUOROFORM. *Anal. Chem., 46(11):1583-1584, Sept. 1974. 1 ref.*

Hexafluoroacetone is harmful at levels below which it is detected by odor. A value of 0.1 ppm has been established as the threshold limit value for industrial workers. Since no procedure was available for the determination of hexafluoroacetone in air, an infrared spectrometric method was developed with satisfactory results down to at least 0.1 ppm. The method uses the haloform reaction that hexafluoroacetone undergoes when treated with alkaline materials and heated to elevated temperatures to convert it to fluoroform. The fluoroform is then measured by its intense infrared adsorption band at 1150/cm. In contrast with hexafluoroacetone, fluoroform is nonreactive and shows no tendency to adsorb on the cell walls. The overall efficiency of collection and conversion of hexafluoroacetone to fluoroform is about 90% of the theoretical one.

41693 **APTIC NO. 65859**

Baldeck, Charles M., G. William Kalb, and Howard L. Crist

DETERMINATION OF ELEMENTAL MERCURY IN AN EMISSION SOURCE HAVING A HIGH SULFUR DIOXIDE CONCENTRATION BY AMALGAMATION WITH GOLD AND ULTRAVIOLET SPECTROHOTOMETRY. *Anal. Chem., 46(11):1500-1505, Sept. 1974. 20 refs.*

The use of gold as a collection medium for the quantitative separation of elemental mercury from stack gases in the presence of 6-8% sulfur dioxide is described. A slightly modified Environmental Protection Agency sampling train with the impingers altered to hold 20-30 g of gold chips was used. The gold amalgam was heated in an induction coil, and the liberated mercury was absorbed in 3% potassium permanganate solution; particulates on the filter were digested in nitric acid. Both solutions were reduced and aerated, and the absorbance was measured at 253.7 nm by an ultraviolet spectrophotometer. Collection of the mercury on gold eliminates several interferences such as sulfur dioxide, hydrogen sulfide, and organic substances which may be present in stack gases and react with liquid absorbing reagents, thus inhibiting their quantitative retention of mercury. The collection efficiency of the filter and the amalgamators was, for most runs, in excess of 95%. The retention of mercury on three gold amalgamators between the sampling rates of 0.3 and 0.7 cu ft/min was well above 95% at sampling times of 5, 10, and 15 min. (Author abstract)

41694 **APTIC NO. 63541**

Beard, Michael E. and John H. Margeson

AN EVALUATION OF THE ARSENITE PROCEDURE FOR THE DETERMINATION OF NITROGEN DIOXIDE IN AMBIENT AIR. *Preprint, Environmental Protection Agency, Research Triangle Park, N. C., Methods Standardization Branch, 41p., March 1974. 18 refs.*

A detailed method write up describing the sodium arsenite manual procedure for measurement of nitrogen dioxide in ambient air was developed. The method involves sampling for 24 hr with a restricted orifice bubbler immersed in a NaAsO2-sodium hydroxide collection solution. The range of the method is approximately 20-750 micrograms/cu m. There was a constant high collection efficiency of 82 + or - 3.7% over the entire range. The method was insensitive to normal variations in orifice bubbler diameter, temperature, temperature of the absorbing solution during sampling, and concentration of NaAsO2. The ruggedness test identified nitric oxide and carbon dioxide as positive and negative interferents, respectively. Sample flow rate may also be a variable affecting the method response. (Author abstract modified)

41695 **APTIC NO. 65812**

Belanger, Guy

DETERMINATION OF SULFUR DIOXIDE BY ANODIC OXIDATION ON LEAD DIOXIDE ELECTRODES. *Anal. Chem., 46(11):1576-1577, Sept. 1974. 10 refs.*

A method to analyze sulfur dioxide in the atmosphere using a lead dioxide electrode as the electrocatalytic oxidizing electrode is described. This method has the advantage that the oxidizing agent is stable, nonconsumable, and active without any potential pre-treatment. Further experimental work is needed to assess the full potentiality for this type of system. For a polarization of +950 mV and a residual current of the order of 20 microA, the oxidation of the SO2 on the PbO2 electrode was completed to 64% of the theoretical value. The signals were reproducible and the time response of the system was about 5 min. The limit in the oxidation efficiency was probably due to the incomplete contact between the electrode and the SO2. For the graphite lead dioxide electrode, the percentage of oxidation was about 20-25%. The difference in electrooxidation efficiency between the two electrodes was related to the difference in contact between the reacting gas and the electrode surface.

41696 **APTIC NO. 64302**

Bell, Frederick J.

GAS SAMPLING TUBE. *(British Petroleum Co., Ltd., London (England)) Brit. Pat. 1,352,135. 3p., May 8, 1974. (Appl. May 15, 1970, 8 claims).*

A gas sampling device is described which has the advantage of greaseless valve samplers but does not permit leakage of air into the sampling vessel. The device consists of a vessel with a tubular inlet having a side arm. A rod on which two washers are mounted in spaced apart fashion is located within the tubular inlet and is moveable forwards and backwards within the inlet. The side arm is connected to the interior of the vessel in the withdrawn position. The thickness of the inner washer is greater than the internal diameter of the side arm, and the tubular inlet is of uniform cross section such that the inner washer provides a sliding seal over the entire length of its movement.

41697 **APTIC NO. 63766**

Belot, Y. and T. Marini

NEUTRON ACTIVATION ANALYSIS OF SOLID AIR POLLUTANTS BY THE INTERNAL STANDARD TECHNIQUE. *(Analyse par activation netronique des polluants atmospheriques solides avec une technique de standard interne). Text in French. J. Radioanal. Chem., 19(2):319-327, 1974. 9 refs.*

The non-destructive neutron activation technique for the simultaneous determination of about 20 elements in particulate air pollutants is described. The particulate matter to be analyzed is separated by a Whatman 41 cellulose filter, and a known quantity of rubidium as an internal standard is deposited on the sample. The unknown sample and the internal reference standard are then irradiated under identical conditions for several days by a thermal neutron flux, after which counting is done on a germanium(lithium) detector. Neutron activation analysis is suitable for the determination of sodium, calcium, scandium, chromium, iron, cobalt, zinc, arsenic, selenium, bromine, molybdenum, cadmium, antimony, cesium, barium, lanthanum, cerium, samarium, lutetium, hafnium, gold, mercury, thorium, and rubidium in particulate air pollutant samples.

41698 **APTIC NO. 64329**

Ben kovskiy, V. G. and G. S. Sapunov

ANALYSIS OF GASEOUS MIXTURES CONTAINING SULFUR DIOXIDE AND HYDROGEN SULFIDE IN THE PRESENCE OF WATER VAPOR. *(Analiz smesey, soderzhashchikh dvuokis sery i derovodorod v prisutstvii parov vody). Text in Russian. Neftepererab. Neftekhim., no. 4:37-38, 1974.*

A simple routine method for the determination of sulfur dioxide, hydrogen sulfide, and other gases in gaseous mixtures containing high concentrations of water vapor at elevated temperatures is described. The gas sample to be analyzed is diluted with a relatively inert gas to prevent water vapor from condensing, after which the gaseous mixture is sent through a series of tubes containing different dry adsorbents for the different gases (calcium chloride for water vapor, anhydrous copper phosphate for H2S, lead dioxide for SO2, and potash for carbon dioxide). The respective gas concentrations are determined from the weight difference of the adsorption tubes before and after adsorption. The adsorption efficiencies for H2S and SO2 were 98.6-99.3% and 99.1-100.9%.

41699 **APTIC NO. 63836**

Bergert, K. H., V. Betz, and D. Pruggmayer

INVESTIGATION OF VOLATILE ORGANIC MICROPOLLUTANTS IN AIR AND WATER USING LOW-TEMPERATURE CAPILLARY GC-MS. *(Untersuchung fluechtiger organischer Mikroverunreinigungen in Luft und Wasser mit Hilfe von Tieftemperature-Kapillar-GC/ Massenspektrometrie). Text in German. Chromatographia, 7(3):115-121, March 1974. 24 refs.*

Sampling, enrichment, separation, and identification of volatile organic micropollutants in air and water by means of low- temperature capillary gas-chromatograph mass-spectrometer system are described. Air is sampled at a rate of up to 1 l/min through magnesium perchlorate for moisture adsorption into a microgradient tube containing silicone oil and chromosorb that is cooled by liquid nitrogen. A sample volume of 30 l is usually sufficient. For enrichment, the organic compounds are driven out of the adsorption tube by helium and condensed in a coil cooled by liquid nitrogen. The organic components are separated by a glass thin-layer open tubular column by linearly programmed low- temperature gas chromatography, using a heating rate of 2 C/min from -10 C to 150 C. The organic components thus separated are sent directly to the ion source of the mass spectrometer which has a sensitivity of 0.02 ppb. The analyses can be performed on commercial equipment.

41700 **APTIC NO. 65846**

Birkle, Michael

ERECTION OF AN AUTOMATIC EMISSION MEASURING GRID. *(Aufbau eines automatischen Immissionsmessnetzes). Text in German. Siemens Z., 48(8):525-532, 1974. 25 refs.*

The structure, hardware, and software of an automatic air quality monitoring network is described. The smallest independent unit of the network is constituted by the data recording unit integrating up to four pollutant analyzers together with the necessary sampling and calibration units and up to four instruments for the recording of meteorological parameters. One or more of such data recording units can be accommodated in one sampling station which is in turn connected to regional subcenters via remote control units. Apart from automatic operation, the individual data recording units can be also controlled manually. Final data processing is done in a computer center. The data recording centers are suitable for the concentration measurement of such air pollutants as sulfur dioxide, hydrogen sulfide, nitric oxide, nitrogen dioxide, total nitrogen oxides, carbon monoxide, carbon dioxide, ammonia, hydrochloric acid, chlorine, hydrofluoric acid, ozone, oxidants, and hydrocarbons.

41701 **APTIC NO. 64325**

Bourbon, P., J. Alary, J.-F. Esclassan, and F. Alengrin

DETERMINATION OF NITROGEN DIOXIDE AND NITROUS ACID IN THE AIR. *(Sur la determination de NO2 et NO2H dans l atmosphere). Text in French. Pollut. Atmos. (Paris), 16(61):39-42, Jan.-March 1974. 4 refs.*

A sampling and colorimetric method for the joint determination of nitrogen dioxide and nitrous acid in the air are described. At a sampling rate of 1-2 l/min, NO2 is absorbed in bubblers containing the Saltzmann reagent, while nitrous acid is selectively adsorbed on GELMAN A type filter previously impregnated with 10% sulfamic acid solution, followed by drying at 25 C. The rate of nitrous acid retention on the filter amounts to about 90%. For the joint determination, the nitrous acid concentrations should be at least 5% of the NO2 concentration due to the slight retention of NO2 by the filter. Colorimetric determination of the azo compound formed as a result of the coupling of the sulfanilic acid diazo compound with N-naphthylethylene diamine is done at 550 nanom. The Beer- Lambert law is obeyed within a range of 0-80 micrgrams/100 ml. The impregnated filter is also suitable for the sampling of nitrates for subsequent determination.

41702 **APTIC NO. 64079**

Bromberg, Steven M., Berne I. Bennett, and Stephen K. Goranson

SURVEY OF SYSTEM PERFORMANCE. ANALYSIS OF SIMULATED AMBIENT CARBON MONOXIDE SAMPLES. *Preprint, Environmental Protection Agency, Research Triangle Park, N. C., National Environmental Research Center, 19p., March 1974. 1 ref.*

An interlaboratory survey was made of systems for sampling carbon monoxide to determine the quality of information being reported, to provide a means of rapid self-evaluation of the CO instrument performance, and to test the practicality and acceptability of providing a large number of CO sample cylinders for evaluation purposes. The survey method, the results of CO cylinder analyses, the response to each participant, results in terms of acceptable range, and statistical analysis of performance are discussed. If the standards of performance used were the acceptable ranges, then 47% of the instruments analyzed all samples accetably and only 2% were not able to analyze any samples acceptably. But the acceptable ranges were constructed based on the technique described and are subject to further refinements. Future ranges may indicate that instruments performing in a similar manner may or may not fall within the acceptable ranges.

41703 **APTIC NO. 63574**

Camp, D. C., J. A. Cooper, and J. R. Rhodes

X-RAY FLUORESCENCE ANALYSIS--RESULTS OF A FIRST ROUND INTERCOMPARISON STUDY. *X-ray Spectrom., vol. 3:47-50, 1974. 10 refs.*

An intercomparison study between 12 investigators and three analytical techniques was conducted to determine the precision and accuracy with which multielement analysis of air particulates on filters can be accomplished using energy dispersive X-ray fluorescence spectrometry. Special emphasis was placed on testing calibration techniques and methods of correction for absorption in both particulate deposits and substrates. Errors in calibration and correcting to substrate absorption can be reduced to much less than 10% for elements potassium and above, but that more work is required to test methods of correcting for particle size and to achieve 10% accuracy at energies below 3 keV. (Author abstract modified)

41704 **APTIC NO. 63707**

Cauwenberghe, J. Van

SURVEY OF AIR POLLUTANTS, MEASUREMENT TECHNIQUES AND MONITORING SYSTEMS. *Tribune CEBEDEAU (Centre Belge Etude Doc. Eaux), 27(364):159-173, March 1974.*

Air pollutant measurement techniques and monitoring systems are surveyed. The most common pollutants measured are sulfur dioxide, carbon monoxide, oxides of nitrogen, oxidants, total hydrocarbons, particulates, and also wind direction and velocity. The sources and effects of each pollutant are briefly discussed. Monitoring systems using Beckmann instruments are described including their operation, applications, construction, and special features. Specific instruments are the Model 951 Nitric Oxide/Nitrogen Oxides Analyzer that operates on the chemiluminescent method of detection and is designed specifically for vehicle emission and stationary source monitoring applications; Models 864/865 which produce infrared radiation from two separate energy sources and measure CO, carbon dioxide, water, NO, and SO2; Model 6800 Air Quality Chromatograph for hydrocarbon analysis; Model 906A SO2 Analyzer which provides an accurate reliable means of continuously monitoring trace concentrations of SO2 in ambient air; and the Model 400 Hydrocarbon Analyzer which utilizes the flame ionization method of detection to determine the concentration of hydrocarbons present in a gas stream or ambient air.

41705 **APTIC NO. 63856**

Cooper, John C., Harvey E. Birdseye, and Russell J. Donnelly

CRYOGENIC SEPARATION OF METHANE FROM OTHER HYDROCARBONS IN AIR. *Environ. Sci. Technol., 8(7):671-673, July 1974. 3 refs.*

Methane has a higher vapor pressure than any other hydrocarbon. Therefore, methane can be separated from the other HC in ambient air by condensing the heavier HC on a suitably cold surface. A cryogenic trap for separating methane based on this idea was constructed and tested with bottled mixtures. The device trapped more than 95% of all the nonmethane HC used and had no measurable effect on methane. When used with a total HC analyzer, the separator established a baseline for nonmethane HC, obviating the problem of settling an accurate HC zero level. The laboratory tests with bottled gases are described. (Author abstract modified)

41706 **APTIC NO. 64361**

Countess, Richard J.

PRODUCTION OF AEROSOL BY HIGH VOLUME SAMPLERS. *J. Air Pollution Control Assoc., 24(6):605, June 1974. 5 refs.*

The Staplex high volume sampler, widely used for atmospheric monitoring, produces carbon aerosol by the abrasive wear of its motor brushes. The aerosol is entrained in air flowing past the motor and is discharged from the rear of the sampler casing. This does not interfere with the use of the Staplex in measurements of a specific contaminant, but might interfere with measurements of total dust load. Therefore, measurements were made of the amount of aerosol produced by the sampler and of the fraction of aerosol that recirculates to the sampler inlet. Recirculation was very low at all conditions tested and did not exceed 0.1%. A carbon aerosol concentration of no more than 0.1% of 150 or 0.15 micrograms/cu m would recirculate in normal circumstances. This can be ignored, for environmental mass dust concentrations are rarely less than a few micrograms/cu m, even in rural areas. But there is a need for caution in some situations in view of the substantial concentration of carbon aerosol produced by the Staplex or other pumps using a centrifugal blower motor with carbon brushes.

41707 **APTIC NO. 63426**

Ettinger, Harry J., Charles I. Fairchild, and Lawrence W. Ortiz

AEROSOL RESEARCH AND DEVELOPMENT RELATED TO HEALTH HAZARD ANALYSIS (PROGRESS REPORT). *Los Alamos Scientific Lab. of the Univ. of California, Los Alamos, N. Mex., Industrial Hygiene Group, Atomic Energy Commission Contract W-7405-ENG-36, National Institute for Occupational Health Proj. RO72, Rept. UC-41, 21p., April 1974. 3 refs.*

NTIS: LA-5555-PR

Aerosol research and development related to health hazard analysis at the Los Alamos Scientific Laboratory is summarized. A new fibrous glass aerosol produced from a hearing protection product was used to provide additional calibration data for the 10 mm nylon cyclone. The aerosols ranged from 3.3 to 5.9 micron in mass median aerodynamic diameter. Long term evaluation of the permanent mounting technique for asbestos samples indicates the stability of these mounts during storage under various temperature extremes. Additional calibration data using polydisperse coal dusts indicate the variation in cyclone performance at flow rates of 1.7 and 2.0 l/m, and reconfirm that the better approximation to the ACGIH respirable dust curve is at 1.7 l/m. Construction of the Standard Coal Aerosol Test System was completed. The unit will produce a controlled, uniform dust cloud with mass concentrations up to 10 mg/cu m, relative humidities ranging from 10-90%, and a flow rate of 100 CFM. (Author abstract modified)

41708 **APTIC NO. 64304**

Firth, Jack Graham and Thomas Alwyn Jones

IMPROVEMENTS IN OR RELATING TO INFRA-RED GAS DETECTORS. *(National Research Development Corp., London (England)) Brit. Pat. 1,352,842. 9p., May 15, 1974. (Appl. May 5, 1971, 21 claims).*

An improved design for infrared gas detector is described which is more simple and suitable for arduous conditions than prior art detectors which rely on filtering techniques or complex optical systems. Electromagnetic radiation is passed from a source (e.g. a glass coated ceramic bead coated with platinum and heated) through the fluid to a detector (e.g., indium antimonide semiconductor photo-conductive cell), with the output of the detector being measured and compared with the output corresponding to a known concentration of the constituent. The source emits radiation the intensity of which increases rapidly with increasing wavelength just below the peak of the absorption band. The detector, as a result of its radiation response characteristics, has a response to the radiation emitted by the source which decreases rapidly with increasing wavelength just above the peak of the absorption band. At least one material, such as a calcium difluoride window, may be interposed between the source and the detector to achieve the proper radiation absorption.

41709 **APTIC NO. 63600**

Fuerst, Robert G. and John H. Margeson

AN EVALUATION OF THE TGS-ANSA PROCEDURE FOR THE DETERMINATION OF NITROGEN DIOXIDE IN AMBIENT AIR. *Preprint, Environmental Protection Agency, Research Triangle Park, N. C., Methods Standardization Branch, 48p., March 1974. 18 refs.*

A detailed method write up describing the TGS-ANSA manual procedure for measurement of nitrogen dioxide in ambient air was developed. The method involves sampling for 24 hr with a restricted orifice bubbler immersed in a triethanolamine, o-methoxyphenol, sodium metabisulfite solution. The range of the method is approximately 20-700 micrograms/cu m. The method is free from interferences such as nitric oxide, sulfur dioxide, ozone, carbon monoxide, and ammonia and possesses a constant 93% collection efficiency. The method is insensitive to normal variation in time between sample collection and analysis, storage conditions after sample collection, flow rate, carbon dioxide concentration, sampling time, and orifice size. The time interval between the addition of the diazonium salt forming reagent and the diazonium salt coupling reagent is critical and must be carefully controlled. The method appears to be a reliable procedure for the measurement of NO2 in ambient air. (Author abstract modified)

41710 **APTIC NO. 63648**

Fuhrmann, Hans

RECORDING STACK MONITORING FOR THE CONTROL OF ENVIRONMENTAL PROTECTION MEASURES AND THE ECONOMIC CONDUCTION OF COMBUSTION PROCESSES. *(Registrierende Schornsteinueberwachung zur Kontrolle des Umweltschutzes und des wirtschaftlichen Verhaltens von Verbrennungsprozessen). Text in German. Wasser Luft Betrieb, 18(4):212-217, 1974. 16 refs.*

Methods for the measurements of the oxides of nitrogen, hydrogen, chloride, and fluoride are discussed in detail and a brief review of the methods available for the measurement of carbon monoxide, sulfur dioxide, and sulfur trioxide emissions is given. The discussion of the NOx measurement methods is preceded by a review of the development of these components in industrial combustion processes. For the measurement of the oxides of nitrogen, the chemiluminescence method and the absorption methods in the infrared and ultraviolet range are described. For the measurement of HCl and HF emissions, samples are taken behind the electrostatic precipitator. The analyzer for these pollutants consists of an ion sensitive electrode. For the recording measurement of CO2 and SO2, a number of primarily physically operative analyzers in the IR and UV range are available. Also analyzers with chemical auxiliary reactions are used. The most difficult problem encountered at the measurement of SO3 is posed by sampling. Here the conversion of the SO2 present in the flue gas to SO3 through the material of the sampling of the sampling probe or the reaction of SO3 with the sampling probe or with dust must be taken into account. The sample flow is taken from the probe at a temperature above 450 C, filtered, and passed over heated pipes (200 C) to the analyzer. Of the familiar SO3 measuring methods such as dew point determination; measurement of the film-forming speed; scrubbing with isapropanol and subsequent photometry or conductivity measurement; and SO3 reaction with condensated water vapor, the two methods mentioned last have been in practical use for a longer period of time.

41711 **APTIC NO. 65816**

Griffith, George A., Peter J. Drivas, and Fredrick H. Shair

AN INEXPENSIVE REMOTE SEQUENTIAL AIR SAMPLER. *J. Air Pollution Control Assoc., 24(8):776-777, Aug. 1974. 9 refs.*

A remote sequential air sampling unit was developed which is compact, lightweight, and quit inexpensive. The sampling device contains a number of spring-loaded syringes which are released sequentially by the motion of a rotary mechanical timer. Field tests indicate that the sampling device can take accurate sequential air samples automatically and contain each sample without leakage for at least a period of 18 hr in an outdoor environment. The device was tested in a study of room ventilation using sulfur hexafluoride as a tracer. (Author abstract modified)

41712 **APTIC NO. 63762**

Gvirtman, B.

HARTMAN AND BRAUN AND AIR POLLUTION PREVENTION. *(Hartman et Braun et la lutte contre la pollution de l air). Text in French. Tribune CEBEDEAU (Centre Belge Etude Doc. Eaux), 27(364):149-156, March 1974.*

Commercially available instruments by Hartman and Braun for emission and pollutant concentration measurement are described. The URAS analyzers are suitable for continuous monitoring of emission of gases which have absorption spectra in the infrared range; namely, sulfur dioxide, carbon monoxide, hydrocarbons, hydrocyanic acid, and nitrous oxide. The LIMAS analyzers, operating with absorption in the ultraviolet and visible range, are used for the measurement of high concentrations of chlorine, nitrogen dioxide, and mercury vapors. The FIDAS flame-ionization detectors have been developed for the determination of the total hydrocarbon content in the air. The paramagnetic oxygen analyzers MAGNOS 2 T and 5 T, and the thermal conductivity analyzers CALDOS 4 T, are also suitable for emission monitoring. The IONOFLUX analyzers are used to detect trace quantities of aggressive gases in industrial sites. The PICOFLUX instruments are used for the monitoring of SO2 concentrations in the air. These instruments measure SO2 concentrations as a measure of the change in the electric conductivity of the test solution in which it is absorbed and oxidized to sulfuric acid. The PICOS instruments with a solid electrolyte are suitable for the monitoring of hydrogen sulfide, nitrogen dioxide, and total nitrogen oxide.

41713 **APTIC NO. 64387**

Hansen, Michael and Frank Dengler

A NEW CARRIER FOR X-RAY DIFFRACTION ANALYSIS OF DUST SAMPLES COLLECTED ON FILTERS. *(Ein neuer Praeparattraeger zur Roentgenbeugungsanalyse von auf Filtern abgeschiedenen Staubproben). Text in German. Staub, Reinhaltung Luft, 34(7):264-266, July 1974. 4 refs.*

A new preparation carrier is described which makes it possible to investigate by X-rays the dust samples precipitated on filter media. The filters are fixed by a vacuum and they can be set at the same time in rotation and oscillation, so that an improvement in the statistical conditions of crystallite is achieved. The lower detection limit of this method for quartz is about 20 micrograms at strongest interference which corresponds to a quartz density of about 4 micrograms/sq cm at a filter area of 4.9 sq cm. The method can be applied only to mica-free dusts. Since numerous dusts contain mica fractions a lower quartz interference has to be used for analysis. The detection limit then is about 50 micrograms or 10 micrograms/sq cm.

41714 **APTIC NO. 64388**

Heidermanns, G.

THE RADIOGRAPHIC DETERMINATION OF THE QUARTZ CONTENT IN THIN LAYERS OF FINE DUST SAMPLES COLLECTED ON FILTERS. *(Die roentgenographische Quarzgehaltsbestimmung in duennen Schichten auf Filtern abgeschiedener Feinstaubproben). Text in German. Staub, Reinhaltung Luft, 34(7):260-264, July 1974. 15 refs.*

In the conventional quantitative X-ray analysis of mixtures the influence of the mass attenuation coefficient must be considered to achieve accurate results. Based on diaphragm filters charged with dust, a method is described in which, by a quantitatively regulated transfer of respirable dust from the diaphragm filter to the silver filter, it is possible to determine, by means of a qualitative X-ray diffraction method, the quartz content of small amounts of material which is of interest for industrial hygiene. By applying sufficiently thin layers the influence of the mass attenuation coefficient on the result of analysis is negligible. The effect of statistical errors with regard to crystallite is assessed.

41715 **APTIC NO. 63737**

Heusden, S. van

AIR-POLLUTION MONITORS BASED ON CHEMILUMINESCENCE. *Philips Tech. Rev., 34(2/3):73-81, 1974. 9 refs.*

Chemiluminescence is the emission of radiant energy from a material as the direct result of a chemical reaction. The emitted radiation is in general characteristic of the reaction. If the intensity of the radiation is used as a measure of the chemical components taking part in this reaction, a high degree of specificity is guaranteed. Four monitors based on chemiluminescence for measuring air pollutants, particularly ozone, nitric oxide, and nitrogen dioxide, are discussed. The first monitor determines the O3 content by making the O3 react with ethylene. The light produced is measured with a photomultiplier tube. The second monitor, also for O3, is based on the reaction between O3, gallic acid, and rhodamine B. The third monitor measures NO and NO2 and is based on the reaction between NO and O3. To measure NO2 as well, the NO2 is reduced to NO. In the fourth monitor, O3 is measured with the aid of gallic acid and rhodamine B, and NO2 is made to produce O3; the NO is first oxidzed for more NO2, and O3 is then produced from it in a similar way. The detection limit of all four monitors is of the order of 1 part in 10 to the 9th power; the output signal is proportional to the concentration over several decades; and the total measuring time is no more than a few seconds. (Author conclusions modified)

41716 **APTIC NO. 64409**

Himi, Yasuji and Fumio Muramatsu

SOME PROBLEMS ON HIGH VOLUME AIR SAMPLER FOR DETERMINATION OF ATMOSPHERIC COPPER. *(Shibai hai boriumu ea sanpura ni yoru taikichu no do no teiryo no mondaiten). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 8(5):738-742, Dec. 1973. 2 refs.*

A commercial hi-vol air sampler was used for quantitation of atmospheric copper. The 24-hr average for Cu ranged between 0.03 and 1.43 micrograms/cu m, showing an abnormally large difference between the minimum and the maximum. To examine the fluctuation patterns of suspended particulate heavy metal concentrations, 11 hi-vol samplers of the same type (Kimoto Electronics K.K.) were installed at the same location. Copper, iron, lead, and manganese in suspended particulates were analyzed by atomic absorption spectrophotometry. The measurements of Fe, Pb, and Mn were relatively stable, but the Cu measurements varied greatly. After various experiments with two hi-vol samplers connected together, it was discovered that the particulates created by the carbon brush of the first sampler were caught by the second sampler. The particulates were discharged by the friction of carbon brushes and Cu computer, and the amount of particulates caught was 2.2-2.7 mg/hr, or which 0.47-0.59 mg/hr was Cu. The sampler was not dependable for determining the amount of suspended particulates and its Cu content.

41717 **APTIC NO. 63665**

Hobbs, J. R., A. E. Barrington, and J. E. Cline

MASS SPECTRUM OF DYNAMITE EFFLUENT. *J. Vac. Sci. Technol., 11(3):557-560, May/June 1974. 7 refs.*

In order to determine the utility of a portable mass spectrometer equipped with a membrane separator as a detector of concealed explosives, the mass spectrum of dynamite effluent recorded by such an instrument was identified. Necessary steps were an analysis of the composition of the effluent and an examination of membrane penetration by oxides of nitrogen. The principal effluent is ethylene glycol dinitrate (EGDN), and mass peaks of the EGDN spectrum were at 30, 46, and 76 micron. However, peaks at 30 or 46 micron may be caused by substances other than EGDN, such as ethyl alcohol, nitric oxide, and nitrogen dioxide. Therefore, a specially constructed chemiluminescence detector was used to measure NO concentration in dynamite effluent. Additional measurements of concentrations of NO2 and total NOx were made with an electrochemical detector. The amount of NO in an air sample saturated with dynamite effluent was typically about 0.05 ppm, and that of NO2 less than 1 ppm. Passage of a calibrated NO sample through a single membrane reduced the NO concentration by about 80%. When an air sample saturated with dynamite effluent (assumed to be about 50 ppm EGDN and 0.05 ppm NO) was applied to a single membrane, the NO concentration after passage again was only about 20% of the original level, so no significant fragmentation of EGDN into NO had taken place during its passage through the membrane. Thus, NOx, because of their low rates of penetration through the membrane, were less likely to interfere than was first expected. Specificity for dynamite could be improved by simple automatic data processing which would utilize the measurement of relative peak heights at 30, 46, and 76 micron.

41718 **APTIC NO. 65777**

Hollaender, W. and J. Schoermann

MASS DETERMINATION OF SINGLE AEROSOL PARTICLES BY OPTICAL INTERFEROMETRY. *Atmos. Environ., 8(8):817-822, Aug. 1974. 10 refs.*

An apparatus for measuring the momentum of single aerosol particles down to 1.8 times 10 to the minus 8th dyn sec is described. The experimental arrangement accelerates particles up to velocities of the order of 150 m/sec. Since the velocity is individually measured, the instrument allows the detection of particle masses of 10 to the minus 12th g. This is equivalent to a spherical particle of unit density and 1.3 micron diameter. The system utilizes an aerosol particle beam in a vacuum chamber. The impact of single particles on a thin elastomer membrane causes small vibrations. Since the membrane is one of the reflecting mirrors in a Mach-Zehnder interferometer, its vibrations are converted into vibrations of the interference pattern. A photodiode serves as a detector. (Author abstract modified)

41719 **APTIC NO. 64240**

Homolya, James B.

A COMPARISON OF IN-SITU AND EXTRACTIVE MEASUREMENT TECHNIQUES FOR MONITORING SO2 EMISSIONS FROM A STATIONARY SOURCE. *Preprint, Environmental Protection Agency, Research Triangle Park, N. C., Chemistry and Physics Lab., 29p., 1974 (?). 6 refs.*

Extractive and in-situ electro-optical instrumentation was compared for the measurement of sulfur dioxide emissions from a pulverized coal power generating boiler under field conditions. Particular areas of interest include: an investigation of the effects of variations in fuel composition, boiler operating conditions, and fly ash emissions on the various measurement systems; a correlation of instrument response with standard EPA compliance test methods; and a determination of several instrument operating criteria such as zero drift, span drift, and maintenance. There was no clear advantage of in-situ over extractive monitoring systems as far as reliability or relative accuracy is concerned. Two in-situ systems both measuring SO2 by ultraviolet absorption has contrasting performance when sampling a stream containing a representative level of particulate fly ash. Measurement systems employing similar sampling methods and detection techniques can be dissimilar in performance, even when sampling the same emission stream. The results of this program has formed part of the technical base for proposed EPA performance specifications for stationary source monitoring systems for gases and visible methods. A similar field study has been initiated to determine test procedures and performance criteria for the measure of nitric oxide/nitrogen oxides from fossil fuel-fired boilers. (Author conclusions modified)

41720 **APTIC NO. 65825**

Hunziker, R. and F. Baum

DETECTION OF OIL DERIVATIVES IN WASTE GASES FROM OIL FIRING SYSTEMS. *(Nachweis von Oelderivaten in Abgasen von Oelfeuerungen). Text in German. Oel Gasfeuerung, 19(7):510-514, 1974. 12 refs.*

A debate on the detection of oil derivatives in waste gases from oil firing equipment, and a study of the effect of the combustion chamber design on the oil particle emission are presented. For the detection of oil derivatives in the flue gas, the pyridine solvent test with filter paper is proposed. Oil-firing equipment is required to emit no oil derivatives, i.e., the filter paper must be oil-free. The pyridine test represents a routine method, and the intoxication hazards due to pyridine are negligible due to the small quantity involved and to the fact that the tests are performed in open air. An evaluation of oil derivative emissions on the basis of organoleptic tests is not applicable due to the inherent subjective differences in sensitivity and perception. The oil derivative emission is greatly influenced by the relation of the combustion chamber geometry to the burner type, as combustion chambers too large for a given burner may emit much oil due to the combustion temperature being too low. The travel of the flue gases through combustion chambers originally designed for coal firing can be increased by firebricks.

41721 **APTIC NO. 63845**

Ichihara, Akira

ACCURACY OF SO2 EMISSION QUANTITY MEASUREMENT. *(SO2 haishutsuryo sokutei no seido ni tsuite). Text in Japanese. Keiryo Kanri Keisoka Keiso (J. Instrum. Control Assoc., Japan), 23(4):11-16, 1974. 9 refs.*

The three most commonly used measurement methods for sulfur dioxide emission quantity are: measurement of SO2 concentration in exhaust gas and flow rate of exhaust gas, measurement of SO2 concentration in exhaust gas, oxygen, and flow rate of heavy oil, and measurement of sulfur concentration in heavy oil and flow rate of heavy oil. The equations for the calculation of SO2 emission quanity by each method and variables in the equation are given in tabular form. The errors involved in the measurement of each variable are examined and numerically evaluated. The examples of calculation errors in each method in the measurement of SO2 emission quantity from boilers using heavy oil containing 1 wt% S are described. In the case of using heavy oil with 1 wt% S content, the SO2 concentration in exhaust gas is several hundreds ppm. Therefore, a SO2 counter for 0-1000 ppm range was used. The errors were calculated in terms of the systematic error and random error. The systematic error and random error of the above-mentioned three methods are -4 and plus or minus 7.1 for the first method, -4 and plus or minus 7.0 for the second method, and + 2.5 and plus or minus 1.5 for the third method, respectively. For measurement accuracy and retention of accuracy, the measurement method should be selected by taking into account the range of emission quantity, emission source, and other considerations.

41722 **APTIC NO. 63895**

Iida, Yasuo, Mitsuru Utagawa, and Koichi Inoue

AUTOMOTIVE EXHAUST GAS TEST METHODS AND THEIR PROBLEMS. *(Jidosha haiki gasu shikenho to sono mondaiten). Text in Japanese. In: Studies on Tokyo Smog. Tokyo Metropolitan Research Inst. for Environmental Protection (Japan), Rept. 3, p. 158-171, March 1974.*

Various types of test methods for automotive exhaust gases are described and measurement equipment is discussed. The test methods are the 4-mode, 10-mode, 6-mode, 7-mode, LA 4-mode, and ECE-mode tests. The sampling methods are the direct method, constant volume sampling (CVS) method, total bag sample method, and proportional sampling method. The analyzers described are: non-dispersive infrared analyzers for carbon monoxide, hydrocarbons, and nitric oxide, flame ionization detector, and chemiluminescence. The total bag sampling method is unreliable because the elements easily react mutually in the bag, and the method is specially unsuitable for measuring NO. The elements can be lost in the filter and the cooler, and while sampling, the change of pressure in the bag may change the emission conditions. The chemiluminescence method is sensitive and its output forms an excellent curve. The quickness of response is equal to NDIR and FID, and the method is suitable for continuous analysis. The problems are the durability of the NO2-NO converter and the possible errors caused by ammonia and other elements.

41723 **APTIC NO. 63964**

Iwanaga, Masaya

A HIGH EFFICIENT GAS CHROMATOGRAPHIC MASS ANALYZER AND ITS APPLICATION TO POLLUTION MEASUREMENT. *(Koseino gasu kuromatogurafu shitsuryo bunsekikei to kogai keisoku e no oyou). Text in Japanese. Keisoku Gijutsu (Meas. Technol.), 2(2):88-97, Feb. 1974. 7 refs.*

The gas chromatographic mass spectrometer (referred to as GC-MS) is a combined analyzer of gas chromatography (GC), which has excellent power in the separation of mixed components, and a mass spectrometer (MS), which exhibits an excellent ability in the structural analysis and identification of simple components. It plays an active part in all fields or organic chemistry as a new analyzer which makes possible the analyses of components which by the former methods (including the simple forms of GC and MS) were impossible. In the GC-MS system, the column of GC and the ion source of MS are connected through a separator, the chromatograph is obtained from a total ion collector instead of the usual detector which detects and records ions in the around the ion beam before mass separation, and the ion beam at the central part is mass separated and gives a mass spectrum. This system eliminates the occurrence of a time delay between gas chromatograph and mass spectrum and the interlocking of data, and gives highly reliable results. The GC-MS analyzer is being applied to the analyses of air pollutants and bad odors, and in the case of the analyses of the air in front of Rissho Women's Univ. two days after the day when photochemical smog occurred for the first time in Japan, besides lower class hydrocarbons, nitrogen compounds and chlorine compounds were indentified.

41724 **APTIC NO. 63719**

Kaneoka, Chikao

ESTIMATION OF SAMPLING LOSS OF PARTICLE DEPOSITION ON PIPE WALL. *(Sanpuringukan e no ryushi chinchaku ni yoru nodo sokutei gosa no suitei). Text in Japanese. Funtai Kogaku Kenkyu-Kaishi, (J. Res. Assoc. Powder Technol, Japan), 11(3):42-46, May 1974. 10 refs.*

Sampling errors caused by particle deposition in pipe walls during particle diffusion, gravity sedimentation, turbulent flow diffusion, static electricity, and thermal deposition are discussed. Accuracy of these measurement methods depend on the electrical charge of the particulates, the temperature gradient, laminar and turbulent flow of the particulates, particle size and density, and operating variables within the sampling methods. Mathematical equations for the estimation of particle deposition according to sampling method and operating variables are presented.

41725 **APTIC NO. 63825**

Kawado, Kenichi

ANALYZERS FOR ENVIRONMENTAL MEASUREMENT---AIR POLLUTION (II). *(Kankyo keisoku no tameno bunseki kei---taiki osen yo ni tsuite Part II). Text in Japanese. Sekiyu to Sekiyu Kagaku (Petrol. Petrochem.), 18(4):85-89, 1974. 8 refs.*

Methods for carbon monoxide measurement including the infrared analyzer, the constant-voltage electrolytic method, and the gas chromatographic method are described with flow diagrams. The infrared analyzer method is characterized by high selectivity, and two types, one with a 0-50 ppm range and the other with 0-100 ppm range, are commonly used. In the electrolytic method, the CO is converted to carbon dioxide in the electrolyte, and the resulting electrolytic current is measured. Effects of interfering components are still unknown. In the gas chromatographic method, the CO separated by the gas chromatographic column is determined by a flame ionization detector. For nitrogen oxides measurement, absorption spectrometry and chemiluminescence are described with flow diagrams. In absorption spectrometry, the combined concentration of nitric oxide and nitrogen dioxide is measured. The sample air is passed through an absorption solution, and the azo dye produced is measured at 545 mm. The NO is oxidized to NO2 prior to the absorption process. In chemiluminescence, the NO concentration is measured by the intensity of luminescence from excited NO2. For determination of NO2, NO2 is reduced to NO and total NOx is measured. The NO2 concentration is the difference between total NOx and NO. For oxidant measurement, the neutral potassium iodide solution method and ethylene luminescence method are described with flow diagrams. In the potassium iodide solution method, the iodine liberated by the passage of sample air is determined either by absorption spectrometry or coulometry. In the luminescence method, the luminescence from the excited ethylene oxide produced by the oxidation of ethylene by ozone is measured.

41726 **APTIC NO. 64342**

Kinard, J. T. and R. C. Propst

DETERMINATION OF LEAD AT THE PARTS PER BILLION LEVEL BY CATHODIC STRIPPING ANALYSIS. *Anal. Chem., 46(8):1106-1109, July 1974. 11 refs.*

Cathodic stripping analysis of metals that form sparingly soluble oxides is a potentially powerful technique for the determination of trace metals in environmental samples. A cathodic stripping technique using a conducting glass electrode was therefore tested for analyzing lead at the ppb level in standard lead solutions. In the current-potential curves, two peaks were observed for lead concentrations greater than 3 ppb -- one at 0.7 V and one at 0.4 V. When the concentration of lead was below 3 ppb, only the diffuse peak over 0.4 V was observed. The area of this peak was a function of the deposition potential, the deposition time and concentration. With increasing concentration, it approached a maximum value which corresponded to a coverage of approximately 0.1 micrograms Pb/sq m which represents approximately 33% occupancy of the estimated 10 to the 15th sites/sq cm on the surface of the conducting glass electrode. The stripping process probably involves the reduction of a partial monolayer of adsorbed Pb(4+) atoms. The potential of 1.35 V selected for the deposition of lead dioxide at the electrode was based on studies of the effect of deposition potential on the stripping behavior. The deposition rate for Pb(2+) at the electrode was determined from a graph of the equation for coulometry in stirred solution. This graph showed a deposition half-time of approximately 1100 sec. The effect of concentration on the development of the individual stripping peaks up to 25 ppb is shown. The stability of lead dioxide deposits at open circuit was measured to determine if the loss would be significant during the time required for the stripping analysis. A rate of loss of 0.0073 + or - 0.0034 mC/min, corresponding to an estimated error of 0.7 ppb for stripping in stirred solution, was found;

the error in a quiet solution would be considerably less. The electron calibration curves and the possible sources of interferences are also discussed.

41727 **APTIC NO. 63862**

Kojima, Shigeyoshi, Hiromi Yoshida, Kenya Goto, Yoshio Sakamoto, and Hiroichi Kimura

AIR POLLUTION OBSERVATION WITH COMPACT LASER RADAR CAR. *Toshiba Rev., no. 90:21-25, April 1974. 8 refs.*

Laser radar (lidar) can be used to obtain pollution measurements remotely. A 100 pps YAG laser radar with a wavelength in the near infrared region was developed to measure atmospheric scattering caused by suspended particulates. A compact laser radar car was developed from an aluminum van to carry the laser radar equipment. This equipment was used to measure atmospheric scattering in Kawasaki. Dust concentrations in Kawasaki are normally about 100 micrograms/cu m, but on May 12 the laser radar system measured 700 microgram/cu m of dust and decreased ozone. The laser radar system can be used to detect inversion layers, Mie scattering, and suspended particulate levels which can in turn be used to forecast heavy smog generation or photochemical smog generation. A radiosonde and the laser radar car were used to measure Mie scattering and temperature inversions at Tateno. The effects of height of measurements, temperature, humidity, winds, and other meteorological factors on these measurements are discussed.

41728 **APTIC NO. 63693**

Kolesnik, M. I., Y. V. Muratova, M. M. Sidey, and M. I. Bukovskiy

SPECTROPHOTOMETRIC DETERMINATION OF CYCLOHEXANOL IN THE AIR. *(Spektrofotometricheskoye opredeleniya tsiklogeksanola v vozdukhe). Text in Russian. Zavodsk. Lab. (Moscow), no. 3:255-256, 1974. 5 refs.*

A spectrophotometric method for the quantitative determination of cyclohexanol in workplace air in caprolactam production is described. An air sample of 1-2 l is taken at a rate of 25-30 l/hr in distilled water, after which 0.2 ml 1% anise aldehyde diluted with acetic acid in 1:1 ratio, and 3 ml 88% sulfuric acid are added. The colored solution containing the condensation product thus obtained is analyzed spectrophotometrically at the absorption maxima of 440 nanom and 560 nanom. The sensitivity amounts to 2 micrograms/4.2 ml. Benzene, isopropanol, n-butanol, ethyl acetate, butyl acetate, phenol, chlorobenzene, toluene, cyclohexane, and methanol in concentrations amounting to 10 times their respective maximum allowable concentrations do not interfere with the analysis.

41729 **APTIC NO. 63754**

Kondo, Masaomi, Tsutomu Nishihara, and Kazuo Makino

SAMPLING AND QUANTITATIVE ANALYSIS OF ORGANIC CYANO COMPOUNDS IN AIR. *(Kukichu no yuki shian kagobutsu no hoshu narabini bunbetsu teiryoho ni kansuru kenkyu). Text in Japanese. Nihon Koshu Eisei Zasshi (Japan J. Public Health), 21(5):275-279, May 1974. 10 refs.*

Sampling and quantitative analyses of acetone cyanohydrin, acrylonitrile and acetonitrile were studied. When gas chromatography was used for quantitative analyses, fine sensitivity was obtained by using deionized water treated with activated charcoal as buffer and column packing with PEG 6000. With this method, proportional relation was found between the height of peak and the density of used organic cyanide compounds in the range from 0 to 7.5 ppm. A 500 ml/min flow speed, 10 l air-drawing volume, and cooling of absorbent were adequate for sampling. The detectable threshold of density with this method are 2.15 ppm for acetone cyanohydrin, 3.46 for acrylonitrile, and 4.46 ppm for acetonitrile.

41730 **APTIC NO. 63770**

Kozyrev, B. N. and V. A. Bazhenov

ANALYSIS OF THE EMPIRICAL FUNCTIONS OF THE SPECTRAL TRANSMISSION THROUGH ATMOSPHERIC CONSTITUENTS. *(Analiz empiricheskikh funktsiy spektral nogo propuskaniya atmosfernykh komponentov). Text in Russian. Izv. Akad. Nauk SSSR, Fiz. Atmosfery i Okeana, 10(2):201-206, May 1974. 19 refs.*

Comparative analysis of empirical functions of the spectral transmission through atmospheric components, such as water, carbon dioxide, and ozone is presented. Buge s function in the absorption bands of atmospheric components requires approximation for the transmittance of ozone, and that both Elzasser s function and the square root law are applicable in the CO2 absorption bands for low rates of radiation absorption only. The logarithmic function is suitable for the characterization of the absorption of minor atmospheric components in a range of 0.2-0.85. Krov s function is best for the absorption bands of minor impurities and also in the 9.6 micron ozone band for low rates of absorption, and for the water and CO2 bands at high absorption rates.

41731 **APTIC NO. 63857**

Krenke, George and Dieter Schoelzke

THE USE OF PROCESS COMPUTER IN AN ENVIRONMENTAL MONITORING SYSTEM. *Siemens Rev., 61(4):170-174, 1974.*

The necessity of maintaining or restoring a cleaner environment has presented a number of problems in connection with the measuring of the impurities and the automating of the monitoring methods employed. A general concept was developed for a super- regional environmental monotroing system. A data acquisition and processing system was developed with incorporates a process computer which plays the part of the central intelligent monitoring and control unit. The system has already proved its value in trial operation, and conforms to the current ideas about the requirements that must be met by an environmental monitoring system. THe hardware and software are also flexible enough to satisfy future requirements. The data acquisition system, the measuring station, the control center, the remote control system installed, the computer equipment installed, and the computer programs used are described.

41732 **APTIC NO. 64375**

Kronberg, Peter

EXPERIENCES WITH THE EARTH RESEARCH SATELLITE ERTS 1. *(Erfahrungen mit dem Erderkundungssatelliten ERTS 1). Text in German. Umschau Wiss. Tech., 74(15):469-481, 1974. 5 refs.*

The ERTS 1 Earth Research Satellite is at present not optimally equipped for projects for control of environmental pollution. The electric signals triggered in the ERTS sensor by gaseous or other pollutants of the air are relatively weak. Improvements in the sensitivity of the sensor system are required. Air pollutants are difficult to spot but can be spotted best in areas with a relatively homogeneous background (for instance over lakes).

41733 **APTIC NO. 63839**

Kubo, Uichi, Seiichiro Nakanishi, and Mitsuo Takaoka

BASIC STUDIES ON AIR POLLUTION MEASUREMENT BY LASER. *(Reza ni yoru taiki osen sokutei no kisoteki kenkyu). Text in Japanese. Kinki Daigaku Kogai Kenkyusho Kenkyu Hokoku (Kinki Univ. Pollut. Res. Inst. Rep.), no. 1:151-153, June 1974. 3 refs.*

The instantaneous measurement of air pollution covering a wide range is impossible by the existing methods of sampling and chemical analysis. The rapidly developing laser technique offers advantages such as instantaneous measurement, measurement covering wide range of areas, and determination of pollutant components on the spot. The laser radar methods for air pollution measurement based on the propagation of monochromatic laser beam with high directivity and laser beam scattering by suspended particulates are nearing the practical application stage. Using pulse oscillator laser, the position of suspended particulates responsible for light scattering is calculated from the propagation time, and the particulate density can be calculated from the scattering light intensity and radiation intensity. The basic experiment on the transmittancy of the laser in air was conducted using argon laser and helium-neon laser. The He-Ne laser was adequately suitable for short-distance measurement. Schematic diagrams of laser transmission measurement equipment and laser radar systems using a small portable ruby laser and Q-switch are given. The procedure and equipment for long range measurement of transmittancy using He-Ne laser, measurement of pollutant gas dispersion by ruby laser, pollutant identification, and concentration measurement by means of the second harmonic wave using Nd:YAG laser are still under development.

41734 **APTIC NO. 64344**

Kuroda, Daisuke

DETERMINATION OF NO IN SMALL AMOUNTS OF SAMPLE BY CLM-NO ANALYZER. *(Kagaku hakko issanka chisso bunsekikei ni yoru shoryo shiryochu no issanka chisso teiryoho). Text in Japanese. Bunseki Kagaku (Japan Analyst) (Tokyo), 23(5):470-476, May 1974. 11 refs.*

A commercial chemiluminescence method (CLM) nitric oxide analyzer was used to determine NO in various effluents and polluted air, but was not useful for measurement of small amounts of sample in the case of laboratory work. A continuous flow system was used for injection of a small sample into the analyzer. The flow system was constructed with a dilution system for introduction of the sample into the analyzer and an injection system for introduction of the sample into the dilution system. In the dilution system, air that passed through the silica gel column and flowmeter was supplied from an air pump into the analyzer with a constant flow rate of 7.5 l/min and pressure of 2.8 kg/sq cm. Four types of injection methods are described. Using these injection methods, the response of the analyzer was measured with standard gases consisting of 89 and 10,300 ppm NO. Concentrations of NO in the sample were obtained by a calculation from the dilutio factor according to an equation or the calibration curve. A linear relationship was obtained between the amount of NO injected in the dilution system and the peak area of the response curve in the range of 10-.0001 mg NO. Reproducibility of the injection methods were 5-15% for one method and 0.8-3.8% for two other methods. Analytical results from the chemiluminescent method were more exact than those from the colorimetric method because the chemiluminescent method gave no loss during the sampling procedure.

41735 **APTIC NO. 65813**

Lech, Jerome F., Duane Siemer, and Ray Woodriff

DETERMINATION OF LEAD IN ATMOSPHERIC PARTICULATES BY FURNACE ATOMIC ABSORPTION. *Environ. Sci. Technol., 8(9):840-844, Sept. 1974. 18 refs.*

By use of flameless atomic absorption techniques, it is possible to determine traces of lead in atmospheric particulates in very small samples. The implementation of flameless techniques is greatly simplified by using porous graphite as a filter medium. Using the Woodriff furnace as the atomization device and cups made of porous graphite, an air sample can be taken and the cup inserted into the furnace for determination with no other chemical or physical treatment. The sensitivity of the determination based on a minimum detectable recorder deflection of 1% is 2.5 times 10 to the -12th g/sample. This is equivalent to 0.005 micrograms/cu m for a 100-cc air sample. When a standard particulate generator was used, the porous graphite compared favorably with Millipore filters. Organic lead, however, was not retained by either type of filter. The techniques described should be readily applicable to other types of flameless devices. (Author abstract)

41736 **APTIC NO. 63909**

Minigishi, Atsuko, Yoshiharu Shinozaki, Tomio Hirono, Kunihiko Asakuno, Toshio Odaira, and Hiroshi Morishima

ELECTRON SPIN RESONATION ABSORPTION OF AIRBORNE DUSTS. *(Kukijin no denshi supin kyomei kyushu ni tsuite (ESR)). Text in Japanese. In: Studies on Tokyo Smog. Tokyo Metropolitan Research Inst. for Environmental Protection (Japan), Rept. 3, p. 366-382, March 1974. 4 refs.*

The electron spin resonance absorption spectra (ESR) of airborne dust collected at three locations during June to August 1972 were measured, and the relative intensity of the spectrum was analyzed in relation to the dust quantity; concentrations of sulfur oxides, oxidants, and nitrogen oxides; and registered number of people afflicted by photochemical smog. The spectrum intensity at Kojigaya was always several times higher than those at Stagaya and Itabashi. However, the characteristic absorption recorded at Osaka on the day of severe photochemical smog affliction was not found. A linear correlation was found between ESR intensity and dust quantity. The ESR intensity per unit dust weight, i.e., the ratio of paramagnetic substance in dust was three times higher at Kojugaya, which was attributable to the exhaust emission from the nearby Keihin industrial area. A significant correlation was found between ESR and SOx, however, the correlation with other pollutants was slight. The eight metal components, chromium, nickel, iron, manganese, copper, lead, cadmium and vanadium, in the dust samples collected at Setagaya were measured by the atomic absorption method. A significant correlation was found between the airborne dust weight and total weight of eight metals. The ratio of total metal weight is about 1.1-3.8%, and 80% were Fe. Only weak correlations were found between ESR and Cu, V, Pb and Cd, while others were insignificant.

41737 **APTIC NO. 64305**

Mogensen, Frederik Kristian

METHOD AND APPARATUS FOR CLASSIFYING PARTICULATE MATERIAL. *(Assignee not given.) Brit. Pat. 1,352,836. 7p., May 15, 1974. (Appl. May 28, 1971, 20 claims).*

A method and apparatus for classifying particulate material according to particle size is described which precludes coarser particles from being deflected earlier, i.e., higher up in the stream, than smaller particles. The material to be classified is fed through a succession of classifying units, each unit including a frame carrying a series of obstacles with a spacing between adjacent obstacles greater than the maximum dimension of the largest particles arriving at this unit. The larger particles thus have a greater probability of being obstructed and deflected laterally by the obstacles than do the smaller particles. The particles leaving a unit spread out as streams having different directions according to particle size with at least a part of the spread of streams leaving one unit, passing directly into a further classification unit, without undergoing any disturbance to the spread during transfer between the obstacles of the two units.

41738 **APTIC NO. 64371**

Moriya, Masahisa

FIXED POLLUTANT EMISSION SOURCE ANALYZERS. *(Kotei hasseigenyo kogai bunsekikei). Text in Japanese. Sekiyu to Sekiyu Kagaku (Petrol. Petrochem.), 18(3):61-65. 1974.*

A general review is given on the development of air pollutant analyzers. The analyzers are largely divided into two categories: the sampler-analyzers for laboratory use, and continuous analyzers for use in established processes. The form; is mainly used in small businesses while the latter is used in industry. At the present time there are 11 manufacturers producing nitrogen oxides and sulfur oides analyzers, 9 manufacturers producing ozone analyzers, and 4, 2,and 1 manufacturers producing dust, soot, and odor analyzers, respectively, in Japan. In additions to these, other analytical apparatus such as the petroleum sulfur meter, the infrared gas analyzer, and the thermal conductivity gas analyzer are also available.

41739 **APTIC NO. 63822**

Murase, Akira

THE AIR POLLUTION AUTOMATIC MONITORING SYSTEM IN KAWASAKI CITY. *(Kawasaki-shi ni okeru taiki osen jido kanshi shisutemu). Text in Japanese. Sekiyu to Sekiyu Kagaku (Petrol. Petrochem.), 18(3):70-73, 1974.*

The automatic air pollution monitoring system in Kawasaki consists of the constant monitoring of environmental pollution and the monitoring of sulfur dioxide concentration at emission sources. Presently the concentration of SO2, nitric oxide, nitrogen dioxide, oxidant, carbon monoxide, dust, total hydrocarbons and saturated HC, and meteorological factors such as wind direction, wind velocity, temperature, and humidity measured at 7 monitoring stations are transmitted to the monitoring center. The data received are analyzed and flashed on a graphic panel board and electric indicator board placed in front of the city hall. The 1-hr value of 11 items (except wind direction) are automatically printed and used for statistically analysis. The SO2 emission quantity at the emission sources, 42 major industries, are measured by two methods, one by measuring SO2 concentration in smoke stack and emission quantity of combustion exhaust and the other by measuring the fuel consumption amount and sulfur content in the fuel. These two methods are used simultaneously for the achievement of more accurate measurement. The flow diagrams of automatic air pollution monitoring system and SO2 monitoring system are shown. The locations of 7 environmental monitoring stations and names of 42 industries involved in SO2 monitoring are given in tabular forms.

41740 **APTIC NO. 63913**

Nakano, Kinju

MEASUREMENTS OF HYDROCARBONS IN THE ENVIRONMENTAL AIR. *(Kankyo taikichu tanka suiso no sokutei). Text in Japanese. In: Studies on Tokyo Smog. Tokyo Metropolitan Research Inst. for Environmental Protection (Japan), Rept. 3, p. 395-405, March 1974. 6 refs.*

Measurement methods for total hydrocarbons and non-methane hydrocarbons using the hydrogen flame ionization detector (FID) presently used in Tokyo are described and evaluated. The continuous analyzer for THC is described with a flow diagram. In this method, the measured value is affected by the flow rate of sample gas, the oxygen interference on FID, and different responses depending on the type of HC. The span of the presently-used instrument is generally within the 10 ppm range, and the sensitivity of at least threefold is required for photochemical smog measurement in the 0.5 ppm C range. For non-CH4 HC measurements, Beckman 6800, Yanagimoto AG-200, Shimazu HCM-3A and Bendix 8201 are described with flow diagrams and evaluated comparatively. The HC measured at Tokogaiken from June to December 1973 by Beckman 6800 are average monthly THC 2.61-3.14 ppm, methane 1.75-1.96 ppm, and non-CH4 HC 0.84-1.20 ppm. The correlation coefficient between monthly average THC and non-CH4 HC is in the range of 0.61-0.98, indicating that the non-CH4 HC concentration can be estimated from THC. The analysis of HC composition by the Apieson Grease method is described and evaluated as a simple and quick analysis method.

41741 **APTIC NO. 63977**

Nakano, Kinji and Akio Izumikawa

OXIDANTS MEASURING METHODS. *(Okishidanto sokuteiho ni tsuite). Text in Japanese. In: Studies on Tokyo Smog. Tokyo Metropolitan Research Inst. for Environmental Protection (Japan), Rept. 3, p. 390-394, March 1974.*

The ozone standardization by the neutral potassium iodide method for the calibration of an oxidant meter is described. The iodine liberated from KI by O3 was determined photometrically. The O3 value measured varied with the concentration of KI solution used due to the vaporization of I2 and liberation of I2 by light at higher KI concentration. The molar ratio of O3 and I2 was equivalent with 1% KI solution. Seven oxidant meters were calibrated by the static and dynamic methods, and the difference in measured values was found in two out of seven cases. The nitrogen dioxide response of the calibrated oxidant meter was in the range of 5.2-11.4%. The passage rates of NO2, nitric oxide, and O3 through the chromium trioxide scrubber used for the removal of sulfur dioxide were measured. The passage rate varied markedly with the humidity. At humidity lower than 10%, the passage rates of NO2 and NO were generally lower, and the passage rate of NO ranged from 61.6-96.3% at 50% and 63.5-97.1% at 70% humidity. The O3 passage rate was higher than 95% in five out of six cases. Based on the measured values obtained, the correction equation for NO and NO2 was derived, and the oxidant correction coefficients were calculated.

41742 **APTIC NO. 63900**

Odaira, Toshio, Tatsukichi Ishiguro, Yoshiteru Iwasaki, Hiroshi Fukushima, and Shunkichi Onozuka

INVESTIGATION AND STUDIES ON PHOTOCHEMICAL SMOG EMISSION SOURCES. (FIXED SOURCES) POLLUTANTS EMITTED FROM FIXED SOURCES. (COMBUSTION EQUIPMENT). *(Kokagaku sumoggu hasseigen ni kansuru chosa kenkyu. (Kotei hasseigen) Kotei hasseigen (nensho shisetsu) kara haishutsu sareru osen busshitsu). Text in Japanese. In: Studies on Tokyo Smog. Tokyo Metropolitan Research Inst. for Environmental Protection (Japan), Rept. 3, p. 190-215, March 1974.*

To establish sampling and measurement procedures for various pollutants in combustion exhaust gas, the hydrogen chloride, nitrogen oxides, sulfur dioxide, hydrocarbon, and dust concentrations were measured at the Chitose refuse treatment plant from September 1972 to May 1973. The average HCl concentrations measured by the silver nitrate method and conductometric method were 740 ppm and 810 ppm, respectively. The average SO2 concentration measured by infrared absorption method was about 35 ppm, and a significant correlation was found with carbon monoxide concentration. The NOx concentration was measured by the modified Saltzman s method, the phenoldisulfonic acid method, infrared absorption, and chemiluminescence. The relationships between nitric oxide concentration, furnace temperature, and damper opening were analyzed, and multiple correlation coefficients were obtained. Fairly high concentrations of chromium, aluminum, bromine, manganese, and vanadium were found in the dust. The THC was measured by the batch and continuous methods, and the result was mostly in the range of 2-3 ppm. The diurnal variation in each pollutant concentration was examined, and positive correlations were found between furnace temperature and carbon dioxide, SO2, and NO, while oxygen showed a negative correlation. Using a sectional boiler, the effect of excess air rate on NOx, SO2, and THC was examined by varying the fuel consumption quantity and damper opening. The NOx emission quantity increased with the increase in excess air rate.

41743 **APTIC NO. 63901**

Odaira, Toshio

INVESTIGATION AND STUDIES ON PHOTOCHEMICAL SMOG EMISSION SOURCES. FIXED SOURCES. *(Kokagaku sumoggu hasseigen ni kansuru chosa kenkyu. Kotei hasseigen). Text in Japanese. In: Studies on Tokyo Smog. Tokyo Metropolitan Research Inst. for Environmental Protection (Japan), Rept. 3, p. 216-223, March 1974.*

In the measurement of smoke emission from fixed sources, the sampling system, including the location of sampling, material, length and temperature of sampling pipes, and adsorption and dissolution of pollutants greatly affect the measured values. The status of smoke emission from city refuse treatment plant and boilers and measurement methods were investigated. The measurement of sulfur oxides concentration by iodimetry, neutralization method, and barium chloranilate method described in JISK 0103 are reviewed. For measurement at the refuse plant, iodimetry with automatic photo-titration apparatus was suitable. For nitrogen oxides, the naphthylethylenediamine method, phenoldisulfonic acid (PDS) method, and ion electrode method described in JISK 0104 are reviewed. The results of measurement by the abovementioned methods are evaluated. The total and individual components of hydrocarbons are commonly measured by gas chromatography using flame ionization detection. The procedure and result are being evaluated. Dust particulates were measured according to the method described in JISZ 8808. The metallic components in dust are measured by radiation analysis and high frequency plasma. The procedure and result of hydrogen chloride measurement by the silver nitrate method and conductometric method are evaluated. The data on emission coefficient of exhaust gases from boiler furnaces, metallurgical furnaces, and incinerators are given as reference.

41744 **APTIC NO. 63646**

Rahn, K. A., G. Beke, and G. Windels

AN AUTOMATIC FILTER CHANGER FOR COLLECTION OF SHORT-PERIOD HIGH-VOLUME AEROSOL SAMPLES. *Atmos. Environ., 8(6):635-643, June 1974. 6 refs.*

An automatic filter changer for collection of short-period high-volume aerosol samples is described for changing up to 24 11-cm filters unattended. Sampling times may be varied from minutes to a day. The flow rate through the glass fiber or cellulose filters is about 30 cu m/hr, and a 1 hr sample from an urban area can be analyzed for about 20 trace elements by neutron activation and for lead by atomic absorption. The filters can be weighed before and after sampling to determine total suspended particulate, and a given filter can be resampled as many times as desired. The use of the instrument is described with an example of a series of 15-min samples collected from an urban area and a summary of the analytical data. Schematic diagrams of the filter changer and associated equipment are also presented. (Author abstract modified)

41745 **APTIC NO. 63464**

Roberts, Nicholas J.

AEROSOL TRACE ELEMENT ANALYSIS USING NEUTRON ACTIVATION AND X-RAY FLUORESCENCE. *California Univ., Livermore, Lawrence Radiation Lab., TID-4500, UC-34, 126p., Feb. 1974. 33 refs.*

NTIS: UCRL-51499

Air filter samples collected in the Kellogg, Idaho Coeur d Alene mining district during 1972 were analyzed to determine the concentrations of trace metallic elements in the air and to look for indications of their sources. The samples were analyzed for 34 elements with instrumental neutron activation analysis, and for six elements with X-ray fluorescence analysis. The enrichment of the element concentrations relative to their worldwide average concentrations in the earth s crust of rock is tabulated and discussed. Yearly average enrichment factors ranging from 0.845 to 901,000 were observed, and individual enrichment factors as high as 6,000,000 were noted. The elements observed are divided into three main groups according to their enrichment factors: those with low enrichment factors (less than 100), which are derived primarily from the soil; those with an intermediate enrichment factor (100 to 1000), which are of uncertain origin (soil and/or mining and smelting); and those with a high enrichment factor (more than 100), which are clearly of mining/smelting origin. (Author abstract modified)

41746 **APTIC NO. 66080**

Robinson, J. W. and J. D. Dake

REMOTE SENSING OF AIR POLLUTANTS BY LASER-INDUCED INFRARED FLUORESCENCE--A REVIEW. *Anal. Chim. Acta., vol. 71:277-288, 1974. 64 refs.*

A review of infrared fluorescence is presented. Emphasis is placed on the experimental evaluation of laser-induced infrared fluorescence as a method for the remote sensing of molecular air pollutants. Methods of fluorescence excitation, fluorescence lifetimes, and possible interferences are discussed. The performance of a hypothetical remote sensing apparatus is evaluated. Experimental results and theoretical calculations indicate that the construction of an infrared fluorescence remote sensing device is feasible. Such a device can be used to detect 0.1 ppm ethylene at 10 km. This sensitivity is sufficient to monitor concentrations of ethylene which are of interest in an urban environment. It may be possible to detect 100 ppm at ranges of 1000 km which could be useful in remote sensing from satellites. (Author summary modified)

41747 **APTIC NO. 63958**

Rosen, J. M. and R. Greegor

JET ENGINE SOOT EMISSION MEASURED AT ALTITUDE. *J. Aircraft, 11(4):243-245, April 1974. 5 refs.*

The measurement of jet aircraft soot at altitude by an aircraft equipped with a photoelectric particle counter is described. The emission index (lb aerosol/1000 lb fuel) was calculated using m equals 4.00 lb/hr and the fuel consumption rates supplied by the engine manufacturer. In reporting exhaust emission levels the operating conditions of the engine must also be taken into account. The emission index is more meaningful when it is given as a function of equivalence ratio (the actual fuel-to-air combustion ratio divided by the calculated stoichiometric fuel to air ratio) which is roughly proportional to the engine speed. The emission index of typical jet engines calculated from ground level measurements is comparable to the actual in flight emission index for altitudes up to 30,000 ft. A properly instrumented aircraft can be used to obtain some worthwhile information concerning emissions at altitude, but the size distribution should be more thoroughly investigated, both theoretically and experimentally. (Author conclusions modified)

41748 **APTIC NO. 63724**

Sacks, Richard D. and John R. Rentner

ANALYSIS OF MICROMETER-SIZE PARTICLES OF MAGNESIUM OXIDE AND MANGANESE DIOXIDE IN LOW RISE-VELOCITY, LAMINAR FLAMES. *Anal. Chem., 46(8):1125-1128, July 1974. 12 refs.*

Few analytical methods have the necessary sensitivity for determining micron-sized particles such as magnesium oxide and manganese dioxide. Emission spectroscopic methods can be implemented at a cost comparable to morphological methods, have the advantage of being highly element-specific, and are very sensitive. The principle limitation to flame excitation methods is that they use low-temperature, high-rise velocity flames. Therefore, the use of low-rise velocity, laminar flames was tested to avoid these limitations. A burner system and calibration procedure was designed for the analysis of individual micron and submicron diameter particles. The design of the burner and gas handling system, and results of tests are discussed. General spectral features, the calibration procedure, and other aspects of the analytical method are reviewed. While the stability and sensitivity of the method for the analysis of micron and submicron particles of even very refractory materials was readily obtained with the low burning-velocity, laminar flames, the calibration procedure using microscopic particle sizing was very laborious and time-consuming. Use of monodisperse aerosol generators should simplify the calibration procedure. The oxycyanogen flame seemed quite safe with only modest safety precautions required. The low cyanogen consumption for the burner permitted relatively economical operation, about $6/hr for continuous operation, in spite of the relatively high cost of cyanogen gas.

41749 **APTIC NO. 63844**

Saito, Takeshi

RETENTION OF ACCURACY AND MAINTENANCE OF CORRELATION SPECTROMETRY SO2 COUNTERS.

(Sokan bunkoho ni yoru SO2 kei no seido iji to mentenansu ni tsuite). Text in Japanese. Keiryo Kanri Keisoku Keiso (J. Instrum. Control, Assoc., Japan), 23(4):20-23, 1974.

By the use of the correlation spectrometer, the atmospheric pollutant concentrations (sulfur dioxide, nitrogen dioxide) can be measured telemetrically. The COSPEC correlation spectrometer using natural light as the light source is compact and light weight, and can be used in air pollution monitoring vehicles, airplane, helicopter, and ships. A wide range of area can be covered in a relatively short period of time, and the pollution map showing diffusion of pollutants, emission quantity in certain area, and its effect of the surrounding area can readily be made. The correlation spectrometry in which the gas concentration is determined by comparison of energy intensities at gas absorption wavelength and non-absorption wavelength is theoretically described. The natural light used as the light source is greatly affected by meteorological conditions. The spectrum of solar energy and altitude of sun are shown in diagrams. Throughout the year, the solar energy reaches its maximum at 11 am to 12 pm, and the altitude of sun suitable for measurements is above 20 degrees for COSPEC Model II and III and above 8-10 degrees for Model IV. In a valley or between tall buildings, the reflection light is used for the measurement. When a natural light source is unavailable or definite measurement distance is required, artificial light sources such as halogen lamps, particularly the xenon lamp, are used. The data on energy distribution of Xe lamps are given. For accurate measurement, the vibration of the instrument due to vehicle vibration should be kept minimal, the measurement temperature should be below 40 C, and the voltage of battery should be checked periodically.

41750 **APTIC NO. 63643**

Schwarz, Frederich P., Hideo Okabe, and Julian K. Whittaker

FLUORESCENCE DETECTION OF SULFUR DIOXIDE IN AIR AT THE PARTS PER BILLION LEVEL.

Anal. Chem., 46(8):1024-1028, July 1974. 9 refs.

A sulfur dioxide detector based on photon counting of the SO2 fluorescence excited by a zinc 2138 Angstrom line is described in terms of modifications for extending the detection limit to the low ppb range. The cell design is modified to reduce scattered light, with the inside of the cell being coated with a non-water-absorbing black Teflon to reduce possible water-SO2 wall interactions. The quenching effect of water vapor on the SO2 fluorescence, previously observed with cadmium 2288 Angstrom excitation, is negligible with the zinc lamp. Data are given for SO2 in air fluorescence measurements as a function of concentration. The detector response is linear from at least 8.6 ppb to 1.8 ppm.

41751 **APTIC NO. 65834**

Shen, Thomas T.

INDIRECT METHOD OF SO2 DETERMINATION FROM COMBUSTION.

Proc. Am. Soc. Civil Engrs., J. Environ. Eng. Div., 100(EE3):795-798, June 1974. 2 refs.

An indirect method of accurately measuring sulfur dioxide emissions from stationary combustion sources is described. It is based on elemental balances of fuel analysis and SO2/carbon dioxide relations in the determining SO2 in stack gases. The method is simple, low cost, accurate, and reliable. The theory, applications, and experimental results in the laboratory and field are described. Previous methods gave lower values of SO2 than calculated values because of losses in the sampling train to SO2 s high solubility in water. The indirect method is much more accurate and especially useful if cost and manpower preclude actual stack tests.

41752 **APTIC NO. 63650**

Sugimae, Akiyoshi

EMISSION SPECTROGRAPHIC DETERMINATION OF TRACE ELEMENTS IN AIRBORNE PARTICULATE MATTER.

Anal. Chem., 46(8):1123-1125, July 1974. 18 refs.

An emission spectrographic method was used for the determination of trace elements in airborne particulate matter collected on a membrane filter. The membrane filter was dissolved in acetone, and the airborne particulate matter separated from the filter. After centrifuging, the power obtained was washed three times with acetone, dried, and mixed with sodium fluoride and graphite powder. The resulting mixture was packed in a graphite cup electrode and excited by a dc arc. Sodium was selected as the spectroscopic buffer to normalize variations in sodium concentration in the samples. Elements such as bismuth, cadmium, lead, tin, and zinc, classified in the volatile element group, were totally volatilized in the first 30 sec of the discharge. The volatilization of beryllium, chromium, copper, manganese, titanium, and vanadium which were divided into the volatility groups of the median volatile or involatile, tended to delay and continued more than 100 sec. The selection of internal reference elements was based upon the similarity of volatilization rates for elements, which fell into two distinct groups. To check the accuracy of the method, the results of atomic absorption analyses were compared with those of emission spectrographic analyses. There was good agreement between the two methods. The relative standard deviation was 13% or less, values which are generally acceptable for most air pollution analysis requirements.

41753 **APTIC NO. 64346**

Tajima, Nobuko and Yoshinari Kurosaka

SPECTROPHOTOMETRIC DETERMINATION OF FORMALDEHYDE IN AMBIENT AIR WITH 3-METHYL-2-BENZOTHIAZOLONE HYDRAZONE: ELIMINATION OF INTERFERING SUBSTANCE, SULFUR DIOXIDE.

(3-mechiru-2-benzochiazon hidorazonho ni yoru taikichu no biryo horumu arude hido no teiryo - bogaibusshits nisanka io no jokyoho). Text in Japanese. Bunseki Kagaku (Japan Analyst) (Tokyo), 23(5):464-470, May 1974. 14 refs.

Methods of measuring formaldehyde at concentrations in the ambient air were tested. The spectrophotometric method using 3-methyl-2-benzothiazolone hydrazone was most sensitive and very easy to use. But sulfur dioxide in the air caused a negative interference with this method. Nitrogen dioxide gave no interference. To eliminate the SO2 interference, it was necessary to remove the SO2 without removing the formaldehyde before bubbling the sample air in the absorbing reagent. A glass fiber filter soaked with an aqueous solution of metal salts such as chromium trioxide, manganese sulfate, titanium chloride, or magnesium sulfate was used to adsorb the SO2. The SO2 was collected by CrO3 and MnSO4, and formaldehyde was caught by CrO3. Therefore, a MnSO4 filter was most useful to eliminate SO2 interference. The filter was prepared by dropping 10 ml of the aqueous solution of MnSO4 at a concentration of 100 mg/ml over a 250 sq cm glass fiber filter. Then the filter was dried, cut to small pieces, and packed in a glass tube. This filter could thoroughly remove 0.35 ppm SO2 in the air. The effective lifetime of the filter varied with the humidity of the air. At humidity above 88%, the removal efficiency over 95% was maintained for 3000 min for passing 0.35 ppm SO2 at the flow rate of 1 l/min. At low relative humidity of 15 to approximately 35%, the efficiency decreased gradually with the passage of SO2. In ambient air with less SO2 and humidity of 25 to approximately 75%, this filter was effective enough to remove SO2. If the relative humidity is very low, it was desirable to use a new filter. It seemed the spectrophotometric method for the determination of formaldehyde was most sensitive and simple if SO2 was removed by this manganese sulfate filter.

41754 **APTIC NO. 63846**

Takahashi, Akira

RETENTION OF ACCURACY AND MAINTENANCE OF SOX COUNTERS BY THE ELECTROCONDUCTIVITY METHOD. *(Yoeki dodenritsuho ni yoru SOx kei no seido iji to mentenansu ni tsuite). Text in Japanese. Keiryo Kanri Keisoku keiso (J. Instrum. Control Assoc., Japan), 23(4):7-8 and 16, 1974. 3 refs.*

Two types of conductometric sulfur oxides counters, one for environmental measurement and the other for source measurement, are described. In both cases, the SOx in sample gas is absorbed in a hydrogen peroxide solution acidified with sulfuric acid, and the increase in the amount of H2SO4 is measured conductometrically. Basic maintenance for both types are the same; however, the maintenance in the sampling system and adjustment procedure are somewhat different. In the case of the environmental SOx counter, the sampling pipe should be washed or changed once a year, and the dust filter is to be cleaned as needed. The adjustment of flowmeter is one of the most important steps in maintenance, since the variation rate in flow amount and measurement error are in 1:1 relationship. The measurement accuracy of reaction solution also has a 1:1 effect on the accuracy of SOx measurement. The adjustment of the instrument can be done more readily with standard solution than with gas. The maintenance lists for other parts are also given. In the case of SOx counter for emission sources, the periodical cleaning of filters, sampling pump, ripple filter and sampling pipes is required. The flow ratio between reaction solution and sample gas is an important factor for accuracy. The zero adjustment can be made by circulating the sample gas in the instrument, and the span adjustment is made using reliable standard gas. Maintenance lists for other parts are also given.

41755 **APTIC NO. 63881**

Takeshi, Goto

RETENTION OF ACCURACY AND MAINTENANCE OF THE NON-DISPERSIVE ULTRAVIOLET SOX METER. *(NDUVho ni yoru SOxdei no seido iji to mentenansu ni tsuite). Text in Japanese. Keiryo Kanri Keisoku Keiso (J. Instrum. Control Assoc., Japan), 23(4):24-26, 1974.*

The non-dispersive ultraviolet sulfur oxides meter is illustrated by a flow diagram. From a sampling probe with heat resistant filter placed in the stack, the sample gas is led to the analytical instrument through a teflon tube maintained at 100 C in order to prevent the dissolution of sulfur dioxide in water. The SO2 concentration is measured by absorption at 280 nm. Most of the trouble with NDUV SOx meters occurs in the sampling system due to clogging in pipes and corrosion of parts by the sulfuric acid produced. The cleaning of the filter and sampling line by back-flushing the clean air is necessary at least once a day for the removal of particulate matter. Inside the instrument panel, all parts and tubes in the sample gas passage are maintained at 100 C. For accuracy maintenance, various indicators in the instrument are checked and if necessary adjusted once a week, and loose parts and leaks are checked once every 6 mo. In this instrument no expendable parts are used, and only periodical maintenance of various indicators and parts are required.

41756 **APTIC NO. 63644**

Talmi, Yair

DETERMINATION OF ZINC AND CADMIUM IN ENVIRONMENTALLY BASED SAMPLES BY THE RADIOFREQUENCY SPECTROMETRIC SOURCE. *Anal. Chem., 46(8):1005-1009, July 1974. 15 refs.*

The applicability of the radiofrequency furnace, a non-flame spectrometric source, to the analysis of trace amounts of cadmium and zinc is described for various environmental samples which include coal, fly ash, gasoline and oil, soil, and plant and animal tissue. Detection limits for Cd and Zn are 5 picograms using the atomic absorption mode and 6 and 8 picograms, respectively, with the atomic emission mode. The samples, once prepared, are analyzed at the rate of five/min, with an average overall accuracy of 6.8% and a reproducibility of 5.5%. Relative sensitivities are in the 0.001-0.5 ppm range. Experimental procedures, including sample pretreatment, are presented along with analytical results for various samples.

41757 **APTIC NO. 63976**

Uehara, Hiromichi and Yasuharu Ijuin

DETECTION OF FORMALDEHYDES IN AUTOMOTIVE EXHAUST GAS BY STARK VOLTAGE SWEEP MICROWAVE CAVITY SPECTROMETER. *(Shutaruku denatsu soin maikuroha kudo bunkoki ni yoru jidosha haiki gasuchu forumu arudehido no kenshutsu). Text in Japanese. Preprint, Japan Chemical Society, Tokyo, p. 681, 1974. (Presented at the Japan Chemical Society, Spring Meeting, 30th, Higashi-Osaka, April 1-4, 1974, Paper IG27.)*

Formaldehydes in automotive exhaust gas were measured by Stark sweep microwave absorption spectrometry. A cavity spectrometer was constructed, comprising a TE 102 mode cavity resonator with a coupling hole, DC voltage sweep electric source 100 kHz transformer, a microwave source AFC circuit, a lock-in amp, and an intensity recorder. Inside the cavity resonator is a metal plate Stark electrode. A standard material gas of 100 ppm formaldehyde was tested by the spectrometer, and than an actual sample was tested. To observe the material at a low pressure, polarizing molecules in the test material were adsorbed at a low temperature and unadsorbed nitrogen and oxygen were eliminated, the adsorbent was heated, and the separated gas was led into the resonator. Various concentrations of formaldehydes were observed by the same operation and a calibration curve was prepared. When 0 to 60 ppm concentration and adsorption intensity were plotted, a line going through the original points were formed with an average error of 2.6 ppm. Exhaust gas from an idling car showed no interference in the spectrum other than formaldehydes, and accurate identification and quantitation were possible. With a further development, this device should be applicable to measurement of various air pollutants.

41758 **APTIC NO. 66076**

Versino, B., M. de Groot, and F. Geiss

AIR POLLUTION - SAMPLING BY ADSORPTION COLUMNS. *Chromatographia, 7(6):302-304, June 1974. 10 refs.*

Results are presented from experiments investigating the quantitative effectiveness of air sampling by dynamic enrichment on porous polymer (Tenax GC) adsorption columns. Adsorption and desorption efficiencies are presented for hexane, two petrol ether fractions, diphenyl, acetone, diphenylamine, and ortho-cresol. Adsorption efficiency values for all of the above compounds are 100%, while desorption values range from 90-100%. The Tenax column appears to be a suitable polymer adsorbent for air pollution sampling and promising for the adsorption of hydrophylic compounds also.

41759 **APTIC NO. 63753**

Vil yanov, V. M.

METHOD FOR THE SEPARATE DETERMINATION OF HYDROGEN SULFIDE, MERCAPTANS AND DIMETHYL DISULFIDE IN THE AIR. *(Metod razdel nogo opredeleniya serovdoroda, merkaptanov i dimetildisul fida v vozdukhe). Text in Russian. Gigiena i Sanit., no. 4:63-65, 1974. 2 refs.*

Colorimetric methods for the separate determination of hydrogen sulfide, mercaptans, and dimethyl disulfide in the air are described. The air containing all these substances is sucked through an absorber system; the first through two absorbers with 3% solution of cadmium nitrate for the adsorption of H2S, then through absorbers with 0.5% solution of mercury acetate for the retention of mercaptans, through a hydrogenizer for the reduction of dimethyl disulfide to methyl mercaptan, and finally through a mercury acetate solution for the retention of methyl mercaptan. The colorimetric method for the determination of H2S is based upon the formation of methylene blue during the interaction of H2S with asymmetric dimethyl-p-phenylene diamine and iron chloride in an acidic medium. The sensitivity amounts to 1 microgram/5 ml. Ethyl mercaptan is determined via the formation of red coloration during its reaction with mercury acetate, dimethyl-p-phenylene diamine and iron chloride. The sensitivity amounts to 1 microgram/5 ml.

41760 **APTIC NO. 63763**

Wafelman, H. R.

DATA ON AIR POLLUTANT CONCENTRATION MEASUREMENTS IN THE NETHERLANDS. *(Quelques informations sur les mesures des immissions aux Pays-Bas). Text in French. Tribune CEBEDEAU (Centre Belge Etude Doc. Eaux), 27(364):134-138, March 1974.*

The automatic air quality monitoring network in the Netherlands, comprising 250 sampling stations with an action radius of 28 km each, is described. The sulfur dioxide concentrations are semicontinuously measured by Air Monitor TNO colorimetric instruments which are also suitable for the measurement of nitrogen dioxide, nitric oxide, ozone, and chlorine concentrations. Automatic Askol chromatographs with flame-ionization detectors are used for the monitoring of methane, ethane, ethene, acetylene, propane, propene, normal and isobutene, hydrogen sulfide, and carbon disulfide concentrations 4 times hourly. The concentration data, along with meteorological recordings, are sent to a computerized data processing center in Bilthoven.

41761 **APTIC NO. 63898**

Watanabe, Takeharu

DIESEL EXHAUST SMOKE MEASUREMENT METHODS. *(Jizeru haikien no sokuteiho ni tsuite). Text in Japanese. In: Studies on Tokyo Smog. Tokyo Metropolitan Research Inst. for Environmental Protection (Japan), Rept. 3, p. 178-183, March 1974. 3 refs.*

The diesel exhaust smoke standard in Japan is presently defined by the smoke concentration (the color of the smoke). A summary of diesel exhaust smoke standards, measurement conditions, and measurement methods in Japan, England, Sweden, France, Belgium, are given. The diesel exhaust smoke consists primarily of soot in the 10-0.1 micron range and some hydrocarbon aerosols and iron rust. The measurement methods for smoke concentration are the reflective method, light transmittancy, and the total weight method. In the reflection method, the pollutant collected on a filter paper by passing exhaust smoke is determined by the reflection of light. In the light transmittancy method, the smoke concentration is determined from the decrease in light intensity when the light of known intensity is passed through exhaust smoke. In the total weight method, the solid pollutant contained in smoke is collected, and the weight per unit volume of smoke is determined. The measurement procedures by these methods are described with schematic diagrams and evaluated.

41762 **APTIC NO. 64341**

West, Philip W. and J. Jaime Chiang

SPECTROPHOTOMETRIC DETERMINATION OF ATMOSPHERIC ACIDITY BY MEANS OF THE DISPLACEMENT OF THE EQUILIBRIUM OF ACID-BASE INDICATORS. *J. Air Pollution Control Assoc., 24(7):671-673, July 1974. 3 refs.*

A method is described for determining the acidity of the air (the sulfur acid aerosol) by means of the spectrophotometric determination of the displacement of the equilibrium of acid-base indicators. The method is simple, sensitive, and free of known interferences. There is no dependence on costly or sophisticated equipment, and the results are reliable and reproducible. The proposed method was successfully applied in measuring the acidity due to sulfuric acid in a field test at a chemical plant. The method is based on the use of bromophenol blue as the reagent for proton determination on samples collected on Teflon or paper filters. The proper collection of samples provides flexibility and reliability for the overall analytical processes. Both Whatman 41 and 5 micron Mitex filters were satisfactory. It is expected that 0.5 micron Fluropore filters will be even more satisfactory. (Author abstract modified)

41763 **APTIC NO. 63476**

Wheaton, William L.

A CONTINUOUS MONITORING SYSTEM FOR COKE OVEN EMISSIONS DUE TO CHARGING. *Preprint, Air Pollution Control Assoc., Pittsburgh, Pa., 29p., June 1974. (Presented at the Air Pollution Control Association, Annual Meeting, 67th, Denver, Colo., June 11, 1974, Paper 74-281.)*

A continuous gas monitoring system was designed, constructed, and operated for coke oven emissions due to charging. The gaseous pollutants monitored were total hydrocarbons (as methane), sulfur dioxide, hydrogen sulfide, nitric oxide, nitrogen oxides, carbon monoxide, and carbon dioxide. Oxygen, hydrogen, and water vapor were monitored to provide the necessary inputs for mass flow determination. The system includes a sample pump system to transport a representative sample from the source to the system over a 200 ft distance. Data were recorded on fast reponse strip charts and a digital data acquisition system output to magnetic tape. The design, considerations, system integration, and some operational characteristics are described. (Author abstract modified)

41764 **APTIC NO. 63549**

White, J. C., W. S. Lyon, J. A. Carter, C. Feldman, and W. D. Shults

ANALYTICAL TECHNIQUES FOR DETERMINING LEVELS AND FATES OF TRACE ELEMENTS IN A FOSSIL-FUELED STEAM PLANT. *Oak Ridge National Lab., Tenn., Analytical Chemistry Div., National Science Foundation/ Atomic Energy Commission Interagency Agreement AEC 40-237-70 and NSF-AG-398, 26p., 1974 (?). 3 refs.*

NTIS: CONF-730817-1

An extensive study was made of trace element flow within a coal- fueled steam power generation plant. Sampling within the plant was directed at establishing material balances for many trace elements. Ecological sampling within the environs of the plant focused on the impact of the plant on the surroundings. Neutron activation analysis, spark-source mass spectrometry, and atomic absorption spectroscopy were used. Nondestructive, absolute neutron activation was used insofar as possible in order to obtain maximum information at mimimum cost. The stable-isotope- dilution technique was used with spark-source mass spectrometry for several elements to obtaine accurate results in addition to semi-quantitative profiles of overall trace element levels. Atomic absorption was used for specific elements that are determined with some difficulty by the other methods, such as mercury. Electron spectroscopy and scanning electron microscopy were also used, primarily for studies of particulate matter. The results are presented with emphasis on the analytical problems and advantages and limitations of the analytical techniques. (Author abstract modified)

41765 ***APTIC NO. 63651***

Yano, Syozo, Tokiyasu Shintani, and Kuniyoshi Otsuka

SEVERAL OBSERVATIONS ON CASCADE IMPACTORS. (Kasukedo inpakuta ni okeru 2,3 no kosatsu). Text in Japanese. Funtai Kogaku Kenkyu Kaishi (J. Res. Assoc. Powder Technol., Japan), 11(3):180- 181, May 1974.

A cascade impactor s performance was examined by applying it to stearic acid particles in a dust chamber and examining its collection rate. Its 10 micron cut characteristic, performance as a low volume air sampler, and distribution measurements of single scattering aerosol were examined. A Shimazu cascade impactor, a Shimazu filter paper dust counter, and a Shibata Chemical filter paper holder were used. The stearic acid aerosols were produced by a LaMere aerosol producer. As a low vol sampler, the impactor s efficiency was 5.16 mg/cu m the first time, 135 mg/cu m the second time, and 50.2 cu m the third time. These figures compared with 52.5 and 49.2 the first time, 123 and 128 the second time, and 45.6 and 42.6 mg for the third time, respectively, for the other two apparatus. The concentration of stearic acid particles was very high, but the reliability of the impactor s measurement of particle distributions was very satisfactory. The results are presented in a graph. The 10 micron cut particle collections of the impactor and the dust counter by simultaneous suction were: 2.2 mg and 5.9 mg for the first time, 0.7 and 0.8 for the second, and 1.7 and 1.7 for the third, respectively. The performances were entirely satisfactory, though the nozzle of the impactor was a round nozzle, and that of the dust counter was a slit.

41766 **APTIC NO. 64365**

Yasue, Genichiro

MEASUREMENT METHODS FOR TOXIC GASES ON PLANT SITES. *(Sagyo genba ni okeru yugai gasu sokuteiho ni tsuite). Text in Japanese. Nenryo oyobi Nensho (Fuel and Combustion), 41(6):49-59, June 1974. 9 refs.*

Atmospheric toxic substances are classified into gases, vapors, mists, dusts, fumes, and smoke, and their characteristics and some examples are given. Various units used for expressing pollutant concentrations and the term permissible concentration are defined. The gas analysis methods are classified into chemical, physical, and biological measurement methods, and measurement ranges of each method covering the permissible concentration range of 0.001 ppm to 5000 ppm are given. The speed, simplicity of procedures, sensitivity at micro-amount levels, accuracy, selectivity, mobility of equipment, and permanence of data recording are the particular requirements for the environmental measurement at plant sites. In the colorimetric analysis of toxic gases, the sampling methods are classified according to the solubility of toxic substances, and commercially available absorption columns are described. In the detector tube method, the sample gas is passed through a glass detector tube filled with detecting agents, and the concentration is measured by the color change of detecting agents as the result of chemical reaction with a specific substance. The gas sampling equipment, concentration table, and color chart used in the detector tube method are also described. The theoretical bases for quantitative determination by the detector tube method are discussed.

41767 **APTIC NO. 63896**

Yoshizumi, Kunio

HYDROCARBON ANALYSIS METHODS FOR AUTOMOTIVE EXHAUST GASES. *(Jidosha haiki gasuchu no tanka suiso bunsekiho). Text in Japanese. In: Studies on Tokyo Smog. Tokyo Metropolitan Research Inst. for Environmental Protection (Japan), Rept. 3, p. 172-173, March 1974. 6 refs.*

In sampling automobile exhaust gas from the tail pipe, it is easy to capture gas directly into a vacuum jar or gas sampler, but adsorption of hydrocarbons on the wall is unavoidable. To prevent adsorption, exhaust gas must be diluted. There are at least 120-130 kinds of HCs in exhaust gas and precision analysis is impossible by an ordinary packed column. The use of a capillary column is indispensable, and an extremely small amount must be introduced to the column at a time. A highly sensitive flame ionization detector is necessary. The entire column must be cooled to -70 C. This column cannot handle C1-C2 low class HCs, and a packed column is also necessary. The backflush method for flushing elements higher than C3 is described.

41768 **APTIC NO. 63897**

Yoshizumi, Kunio

ANALYSIS METHODS FOR ALDEHYDES IN AUTOMOTIVE EXHAUST GASES. *(Jidosha haiki gasuchu no arudehidorui no bunsekiho). Text in Japanese. In: Studies on Tokyo Smog. Tokyo Metropolitan Research Inst. for Environmental Protection (Japan), Rept. 3, p. 175-177, March 1974. 11 refs.*

The direct analysis methods for automobile exhaust gas are colorimetry and gas chromatography. Another method is to stabilize aldehydes by reacting them with hydrazine to eliminate the interference by coexisting elements in exhaust gas, and, after forming nonsoluble 2,4-dinitrophenyl hydrazone with hydrochloric acid and 2,4-dinitrophenyl hydrazine, colorimetry, the weight method, or gas chromatography is applied. With direct method colorimetry the interference of aliphatic aldehydes is a problem. Gas chromatography requires a highly sensitive capillary column. With the weight method, each aldehyde molecular weight difference must be taken into consideration. Analyses of aldehydes require simultaneous measurement of various elements by a simple operation, and therefore gas chromatography is most suitable. Further studies are required to simplify the pretreatments.

41769 **APTIC NO. 65808**

Zeller, M. V.

INSTRUMENTAL ANALYSIS OF TEXTILE AIR POLLUTANTS. *Am. Dyestuff Reptr., 63(8):29, 31, 51, Aug. 1974. 5 refs.*

Although the textile industry is only a minor source of air pollution, it must comply with the regulations established by the National Institute of Occupational Safety and Health. Therefore, textile manufacturing facilities must be able to identify and determine the amount of various pollutants generated. Various types of atmospheric contaminants occurring in a textile processing plant are described, and measurement methods for these pollutants are surveyed. Microscopic, atomic absorption, infrared spectroscopic, and gas chromatographic instrumental techniques used for analyzing these pollutants are discussed.

41770 **APTIC NO. 63466**

Black, Francis M., Larry E. High, and John E. Sigsby

METHODOLOGY FOR ASSIGNMENT OF A HYDROCARBON PHOTOCHEMICAL REACTIVITY INDEX FOR EMISSIONS FROM MOBILE SOURCES. *Preprint, Environmental Protection Agency, Research Triangle Park, N. C., Chemistry and Physics Lab., 33p., 1974 (?). 5 refs.*

An analytical scheme is proposed which permits assessment of the photochemical significance of light duty mobile source hydrocarbon emissions. The scheme incorporates both the mass and atmospheric reactivity of the HC emissions. The integration of this newly developed gas chromatographic procedure for measurement of nonreactive HC with previously described subtractive techniques for measurement of the HC reactivity classes is discussed. The system includes four packed columns operated in a Perkin-Elmer Model 900 gas chromatograph equipped with a flame ionization detector for nonreactive HC measurement. Analytical procedures supplementary to those defined for light duty mobile source certification in the Federal Register are defined. The analytical procedures permit definition of four basic reactivity classes of

HC: Class I, nonreactive, including methane, ethane, acetylene, propane, and benzene; Class II, reactive, including the C4+ paraffins; Class III, reactive, including the aromatics less benzene; and Class IV, reactive, including the olefins. Procedures for assignment of a Hydrocarbon Photochemical Reactivity Index utilizing the reactivity definition in conjunction with the mass of emissions are described in detail. (Author abstract modified)

41771 **APTIC NO. 64184**

Verein Deutscher Ingeniuere Kommission Reinhaltung der Luft, Berlin (West Germany), Arbeitsgruppe Messen von Schwefeldioxid und schwefeldrioxid im Ausschuss Messen von Grassen

GASEOUS EMISSION MEASUREMENT. DETERMINATION OF SULPHUR DIOXIDE CONCENTRATION. IODOMETRIC THIOSULFATE METHOD. *(Messung Gasfoermiger Emissionen. Messen der Schwefeldioxid-Konzentration. Jod-Thiosulfate-Verfahren). Text in German. VDI (Ver. Deut. Ingr.) Richtlinien, no. 2462:1-4, Feb. 1974. 6 refs.*

A method for the determination of high sulfur dioxide concentrations by the iodometric thiosulfate process is described. The gas sample to be analyzed is sent through quartz wool for dust separation, after which it is admitted into a first absorber containing 0.1n iodine solution, and then through another absorber filled with 0.1n sodium thiosulfate solution with starch as the indicator. At a measuring time of 10 min, the sampling rate should between 20 and 180 l/hr. The SO2 present in the gas sample is oxidized to sulfuric acid by the iodine solution, after which the excess iodine is titrated by the sodium thiosulfate. The difference between the iodine input and output is a measure of the SO2 concentration. Determination is not interfered with by other gases, such as hydrogen sulfide, nitrogen oxides, and halogens, in a SO2 concentration range of 5-60 mg/cu m. The limit of sensitivity is 0.06 g/cu m. The method is applicable to flue gases from firing equipment and other industrial gases containing no components interacting with the iodine solution.

41772 **APTIC NO. 64273**

(Inventor not given.)

DEVICE FOR DETECTING HYDROCARBON COMPONENTS IN A GASEOUS MIXTURE. *(Union Carbide Canada Ltd., Toronto (Ontario)) Brit. Pat. 1,347,389 5p., Feb. 20, 1974. (Appl. May 26, 1971, 10 claims).*

A device for detecting hydrocarbon components in a gas mixture such as air is described. Previously known devices are generally more complex and expensive. A laminated strip is rigidly secured at one end to a support and freely moveable within a predetermined range at the other end. The first layer is hydrocarbon polymer and the second layer is a non-solvent material for hydrocarbons. The other components in the mixture are insoluble in both layers. The device may be simple, relatively inexpensive, and easily adaptable to the detection of particular hydrocarbons depending upon the material used in the lamination of the strip. In accordance with the general chemical principal that a compound of a certain chemical structure often acts as a solvent for a compound of similar structure, the material of the first layer which will swell and extend during sensing can be chosen to react to a wide or narrow range of chemicals. For instance, since it is desired to sense only hydrocarbons, the first layer material of the laminate is made of a nonpolar hydrocarbon polymer. The second layer material of the laminate is made of a non-solvent material for hydrocarbons, e.g., a metal. The bending of the laminated strip upon swelling of the first layer material may be utilized in a great many ways to indicate the presence of a hydrocarbon component or its concentration. One method is to have the strip complete an electrical circuit.

41773 **APTIC NO. 65817**

THE ENVIRONMENT. *(Leefmilieu). Text in Flemish. Ann. Mines Belg., no. 4:27-30, April 1974.*

Systematic air pollution monitoring carried out in Belgium is surveyed. Air pollution is monitored by systematic determination of the pH value, water-soluble and water-insoluble fractions, as well as the sulfate ion contents in precipitation samples in an industrial area, by the use of rain gauges and vaseline layers. Comparative measurements of the sulfur dioxide concentrations by acidimetric titration and colorimetric titration revealed that the latter method gave concentration values about 10% lower than did the acidimetric titration. Comparative air pollution measurements on workdays and Sundays with traffic ban revealed no considerable change in the SO2, carbon monoxide and hydrocarbon concentrations, while the locally recorded nitrogen oxides concentrations fell sharply. A national air pollution monitoring network with computer center is being planned.

1973

41774 **APTIC NO. 64009**

Altshuller, A. P.

MEASUREMENT AND COLLABORATIVE TESTING FOR IMPLEMENTATION OF AIR QUALITY. *Society of Engineering Science, Pollut. Eng. Sci. Solutions, Proc. Int. Meet. Soc. Eng. Sci., 1st, Tel Aviv, Israel, 1972, p. 398-414, 1973. 29 refs. (June 12-17.)*

Instruments used to measure air quality are reviewed. Particulate matter is usually measured by the high-volume method. This method is the reference method for measuring the air quality standard for total suspended particulate matter. The minimum detectable amount of particulate matter is 3 mg which is equivalent to the low ambient air loading of 1-2 micrograms/cu m for a 24-hour sample. Many measurement techniques are used to measure particles in the 0.1-10 micron size range, but generally only the high-volume and tape sampler methods are used in field studies. Particles equal to or below 1 micron can be measured by nephelometry. The reference method for determining sulfur dioxide is the West-Gaeke method. Various other methods of measuring sulfur oxides are described including condensation nuclei, conductometric, correlation spectrometry, coulometric, electrochemical transducer, flame photometric, and second derivative spectrometer. The reference method for measuring carbon monoxide is non-dispersive infrared spectrometry. Other methods which can be used include gas chromatography, infrared fluorescence spectrometry, and the ultraviolet mercury replacement method. The reference method for measuring ozone and other oxidants is chemiluminescence. Other measurements include colorimetric and electrochemical methods. The standard method to measure hydrocarbons is the flame ionization detector. The reference nitrogen dioxide method involves the Griess-Saltzman reaction; chemiluminescent analyzers for nitric oxide and nitrogen oxides have been developed. These various methods, their characteristics, and studies using them, are discussed. The air quality standards for the pollutants are reviewed, calibration techniques and reference materials are discussed, and the standardization of measurement methods and equivalency methods are discussed.

41775 **APTIC NO. 64310**

Burrell, Geoffrey John, Donald Edward Killick, and Douglas Alfred Bateman

IMPROVEMENTS IN OR RELATING TO ATMOSPHERIC VISIBILITY MEASURING APPARATUS. *(Secretary of State for Defence, London (England)) Brit. Pat. 1,337,041. 4p., Nov. 14, 1973. (Appl. Jan. 13, 1972, 8 claims).*

An apparatus for measuring atmospheric visibility is described which overcomes prior art drawbacks involving complications due to different air layer visibilities and the dependency of the proportion of light scattered towards the detector on the angle between the projected beam and the line of sight to the detector. The device includes a projection means and a detection means which are relatively mounted so that first and second beam paths will intersect at a predetermined angle and at a predetermined distance from the detection means and so that the detection means will receive light scattered from the part of the beam where the two beam paths intersect. A control means is also included for turning the two beam paths in unison about a horizontal axis extending from the projection means to the detector.

41776 **APTIC NO. 63624**

Cooper, J. A.

REVIEW OF A WORKSHOP ON X-RAY FLUORESCENCE ANALYSIS OF AEROSOLS. APRIL 4-6, 1973. *Battelle Memorial Inst., Richland, Wash., Pacific Northwest Labs., National Science Foundation RANN/TT/GI-38226/TR-73-5, 31p., June 1, 1973. 89 refs.*

NTIS: BNWL-SA-4690

Twenty-eight participants attended and contributed to a 3-day workshop on X-ray fluorescent analysis of aerosols. Aerosol sampling techniques, methods of X-ray excitation and analysis, quantitative procedures, and other independent methods of analysis were discussed. It was generally agreed that of the energy- dispersive X-ray fluorescence techniques, mono-energetic photon excitation offer the best detectabilities. Proton excitation appears to offer greater sensitivity for the analysis of small quantities of material on thin backings, while photon excitation appears to be more versatile and applicable to thicker samples. Wavelength-dispersive X-ray fluorescence seems to have better detectability for lower atomic number elements and is generally applicable to aerosol analysis. X-ray fluorescence can be used for definite quantitative analysis of titanium, vanadium, chromium, nickel, copper, zinc, arsenic, selenium, bromine, strontium, zirconium, molybdenum, cadmium, tin, barium, and lead in urban aerosols and for semi-quantitative analysis of sodium, magnesium, aluminum, silicon, phosphorus, sulfur, chlorine, potassium, and calcium. Membrane filters are generally preferred for X-ray fluorescence analysis. Standards and correction factors used are adequate for most elements but must be established for elements with atomic numbers below titanium. Current computer programs are adequate for the more abundant elements, but further work is required for effective analysis of low intensity and complex peaks. The publication of additional quantitative results and quantitative intercomparison studies would greatly advance the general acceptance of X-ray fluorescence as a quantitative tool for aerosol analysis. (Author summary)

41777 **APTIC NO. 64353**

Crawford, Richard W., Lester P. Rigdon, and Richard J. Thompson

METHOD AND REAGENT FOR DETERMINING NITROGEN OXIDES. *(Atomic Energy Commission, Washington, D. C.) U. S. Pat. 3,776,697. 5p., Dec. 4, 1973. 10 refs. (Appl. April 13, 1972, 9 claims).*

A method for measuring nitrogen oxides in the atmosphere is discussed. The sample is contacted with the Hochheiser solution comprising a dilute base with or without agent containing small amounts of osmium oxide, xenon oxide, or perxenate whereupon at least 90-95% of the nitrogen dioxide is adsorbed, yielding nitrate and nitrite in the solution. Nitrate may then be converted to nitrite by reduction in a cadmium amalgam cell. Then the amount of nitrite is determined photometrically using Saltzman s reagent comprising (n-1-naphthyl)-ethylene diamine and sulfanilic acid which forms a dye specifically with the nitrous radical. The collection efficiency of the Hochheiser solution is increased from 25-70% to above 90%, yielding a more accurate indication of the NO2 content than previous methods using the Saltzman or Hochheiser solutions alone. (Author abstract modified)

41778 **APTIC NO. 63816**

Crowley, John H.

PORTABLE SMOKE MEASURING DEVICE. *(Assignee not given.) U. S. Pat. 3,779,650. 6p., Dec. 18, 1973. 6 refs. (Appl. June 25, 1971, 5 claims).*

A portable device is described for visual measurement of smoke that includes first and second discs that are supported in overlapping relation for rotation relative to each other. Each disc has means effecting the opacity of light passing through with the two means cooperating to vary the opacity of the selected area of the disc in response to angular rotation of the discs relative to each other. The device has a means for indicating the degree of opacity of the selected area which is located in juxtaposed relation to a stream of smoke emanating from a stack. The discs can be rotated relative to each other until the opacity of the selected area corresponds to the opacity of the smoke. In one embodiment, the discs are of the exposed photosensitive plate type and have a peripheral area of progressively increasing opacity that are placed in overlapping relation to vary the opacity of the two discs while in an alternate embodiment the discs are polarized so that relative rotation will decrease the amount of light passing through. This device eliminates the need for being in close proximity to the column of smoke being measured. (Author abstract modified)

41779 **APTIC NO. 64227**

Decker, C. E., T. M. Royal, and J. B. Tommerdahl

DEVELOPMENT AND TESTING OF AIR MONITORING SYSTEM. *Research Triangle Inst., Research Triangle Park, N. C., Environmental Protection Agency Contract 68-02-1011, Program Element 1A1003, Rept. EPA-650/2-74-019, 219p., Dec. 1973. 15 refs.*

NTIS: PB-231666/AS

Instrumentation based on specified measurement principles selectcd for the Regional Air Pollution Study (RAPS) was tested and evaluated in an experimental trailer. The instruments were evaluated at a non-urban site to determine if the monitors selected for the study can meet the required performance specifications or need to be modified, to determine the operating environment needed to obtain optimum performance from these monitors, to evaluate the latest calibration techniques and select calibration procedures to provide the most reliable measurements, and to recommend instrumentation for use in the RAPS program. Instrumentation for the measurement of ozone, sulfur compounds (sulfur dioxide, hydrogen sulfide, total sulfur), nitric oxide, nitrogen dioxide, hydrocarbons (total hydrocarbon, methane, non-methane hydrocarbon), and carbon monoxide in ambient air were included in the program. The evaluation of each instrument was a systematic comparison of its ability to obtain reliable data with emphasis placed on implementation, if possible, of design changes to instrumentation that could not meet the operational requirements specified for this program. (Author abstract modified.

41780 **APTIC NO. 63472**

Doyle, B. W.

SAMPLING A TURBINE ENGINE EXHAUST FOR AVERAGE EMISSIONS. *Preprint, American Society of Mechanical Engineers, New York, 9p., 1973. 8 refs. (Presented at the American Society of Mechanical Engineers, Gas Turbine Division Winter Annual Meeting, Detroit, Mich., Nov. 11-15, 1973, Paper 73-WA/GT-9.)*

The method of obtaining an average value for the exhaust emissions from a turbine engine at a fixed power setting is explored. The general characteristics of a gas turbine exhaust are discussed and concepts are presented for designing a multiport probe which will collect a sample representative of the average engine emissions. Fixed multiport probes can give values for average engine emissions which are as good if not better than the results of multipoint traversing. A temperature traverse will show the shape of nitric oxide and fuel/air profiles. Profile shapes of unburned hydrocarbons and carbon monoxide tend to be random and unpredictable, but may have small enough fluctuations to allow accurate sampling with a relatively simple averaging probe. Emission measurements in a combustor development rig can provide repeatable values which are close to the engine average emissions using the same combustor. (Author conclusions modified)

41781 **APTIC NO. 63793**

Forrest, Joseph, James H. Klein, and Leonard Newman

SULPHUR ISOTOPE RATIOS OF SOME POWER PLANT FLUE GASES: A METHOD FOR COLLECTING THE SULPHUR OXIDE. *J. Appl. Chem. Biotechnol., 23(12):855-863, 1973. 15 refs.*

Analyses of flue gases from fossil fuel power plants for both concentrations of sulfur oxides and the distribution of stable sulfur isotopes therein have been made. Apparatus and procedures are described for isokinetically sampling flue gas and collecting adequate samples for mass spectromety. The described technique proves to be a reliable method for collecting samples of sulfur oxides from combustion gases and for studying the distribution of stable sulfur isotopes therein. The technique includes methods for sampling sulfur dioxide, sulfur hexafluoride, and sulfuric acid. The sampling probe is described in detail.

41782 **APTIC NO. 64010**

Friedman, Howard A. and Howard J. Mason, Jr.

THE USE OF AIRBORNE SENSOR SYSTEMS FOR ENVIRONMENTAL MONITORING. *Society of Engineering Science, Pollut. Eng. Sci. Solutions, Proc. Int. Meet. Soc. Eng. Sci., 1st, Tel Aviv, Israel, 1972, p. 415-433, 1973. 10 refs. (June 12-17.)*

National Oceanic and Atmospheric Administration Research Flight Facility (RFF) research programs are reviewed. Some of these studies use remote sensing systems on aircraft to monitor air pollution. The operational capabilities of RFF aircraft and RFF aircraft instrumentation are listed. During the past decade there has been a renewed interest in cloud physics and cloud/weather modification. Ice nuclei measurements can be taken with the Bigg-Warner cold-box system. Cloud particle measurements can be taken with an airborne continuous cloud particle replicator to obtain the spectra of 5-200 micron particles and with an airborne continuous hydrometer sampler for 200 micron to 3.8 cm particles. All RFF aircraft are also equipped with military type radiation detection units to investigate electrical and cosmic phenomena. These instruments are described and discussed. Sensors for the measurement of the transport of pollutants are also described. These include methods to measure horizontal and vertical winds. The RFF has provided support of the NOAA s Air Resources Laboratory in an air mass modification project in the U. S. and a study of the spatial distribution of carbon dioxide in the lower equatorial troposphere. The RFF provided support to the Institute of Marine Science of the University of Miami in studies of the air-sea exchange of water in hurricanes, the occurrence of stratospheric subsidence into the hurricane eye, the modification of the air mass over the ocean, and the vertical distribution of tritium in the tropical atmosphere. The RFF supported the ESSA Radiation Branch research involving nuclear reactor experiments. The RFF also worked in support of hurricane research. Future programs of the RFF are also discussed.

41783 **APTIC NO. 63951**

Gant, Preston L., Bill G. Motes, and Jerry T. Aylor

APPARATUS FOR COLLECTION AND MEASUREMENT OF THE AMOUNT OF MERCURY VAPORS PRESENT IN A VOLUME OF AIR OR OTHER GASES. *(Continental Oil Co. Ponca City, Okla.) U. S. Pat. 3,778,162. 5p., Dec. 11, 1973. 7 refs. (Appl. March 24, 1972, 6 claims).*

An apparatus for the collection and measurement of the amount of mercury present in a volume of air or other gases is presented. The apparatus includes a hollow chamber having a noble metal absorbent mounted therein for the absorption of mercury vapor present in gases passed through; a power source connected to the absorbent for heating; a light source mounted at a first end of the chamber; a first photo cell at a second end of the chamber positioned to receive a beam of light emanating from the lamp passing through the chamber; a mercury vapor reservoir adjacent to the first photo cell and positioned in order that the beam of light emanating from the lamp passes through the reservoir prior to receipt by the first photo cell; a second photo cell at a second end of the chamber positioned to receive a beam of light emanating from the lamp passing through the chamber without passing through the mercury vapor reservoir; a means for measuring the absorbance of the first and second photo cells and calculating the differential when the means for heating is activated; and a means for exiting the gases after the activation and measurement has been completed. This invention provides a simple efficient reproducible trap for both collecting and measuring the mercury vapor, requiring only a small amount of power for the desorption of the collected mercury on the absorbing material which allows for use in light aircraft or land vehicles. (Author abstract)

41784 **APTIC NO. 64311**

Inao, Norito, Akira Ezaki, Shigemi Hayashi, Yukio Nakamori, Keihachiro Tanaka, Nobukuni Nakano, and Toshihito Morita

SAMPLING APPARATUS FOR ANALYZING GAS. *(Nippon Steel Corp., Tokyo (Japan)) Brit. Pat. 1,340,918. 7p., Dec. 19, 1973. (Appl. April 8, 1971, 6 claims).*

A sampling apparatus for collecting and precisely analyzing dust-rich, high temperautre and high humidity gases from furnaces and other sources is described which overcomes problems encountered with separation and analyzing errors associated with wet sampling (spraying) systems and thermal expansion pressures on the sampling filter associated with dry sampling methods. A ceramic filter is fitted to the tip of a gas outlet pipe provided within a cooling cylinder, and a mechanism for blowing the gas to remove the dust is positioned near the filter. Means are provided for absorbing the thermal expansion of the ceramic filter.

41785 **APTIC NO. 64380**

aniya, Akio and Tetsuio Sakai

STUDIES OF VEHICLE EXHAUST (II). PROBLEMS FOR THE DETERMINATION OF ACROLEIN. *(Jidosha haiki gasu seibun ni kansuru kenkyu (II), akurorein sokutei no mondaiten). Text in Japanese. Nagoya-shi Kogai Kenkyuso-ho (Rep. Environ. Pollut. Res. Inst., City Nagoya), no. 2:35-38, 1973. 6 refs.*

The determination of acrolein in automotive exhaust gas by 4-hexylresorcinol is relatively free of interference by other substances and sensitive enough for various hygienic tests. However, the fact that the blue color signifying the presence of acrolein does not always apoear suggests interference by other substances. This test examined such interferences. In spectrophotometry, the presence of light increases absorption. Therefore, absorbent should be mixed immediately before the measurement and light should be shut off completely before the quantitation. Aldehydes generally obstruct absorption, and formaldehyde reduces light absorption by half when 30 micrograms is present. Crotonaldehyde does not seem to affect spectrometry. Acetaldehyde reduces absorption up to 10 micrograms, but after that no change is noted. Propionaldehyde reduces absorption up to 100 micrograms, but with more than that amount, the color changes from blue to red, then to purple, and absorption increases drastically. Other interfering substances are benzaldehyde, cyanogen, and ammonia.

41786 **APTIC NO. 64155**

Lindahl, Bo Oscar, Seth Eric Valentin Lamme, and Sven Joseph Harry Hallenrud

CALIBRATING DEVICE FOR APPARATUS FOR DETERMINING CLEANNESS OF AIR IN A CONTROLLED ENVIRONMENT. *(Saab-Scania AB, Linkoping (Sweden)) Brit. Pat. 1,326,343. 5p., Aug. 8, 1973. (Appl. April 22, 1971, 5 claims).*

A calibrating device for an apparatus for determining cleanness of air in a controlled environment is described. All newly manufactured apparatuses are calibrated so that their measuring deflections agree with a measuring level chosen to serve as a normal. This calibration occurs in such a way that a primary normal in the form of a light deflecting plate which is insensitive to dust and deflects a flux of light that has a known relation to a corresponding accumulation of particles is inserted into the housing of the apparatus and is measured with respect to deflected light. The deflection of the pointer of the measuring instrument obtained is adjusted by means of calibrating resistances in the amplifier to a fixed value for the primary normal measured in scale divisions on the scale of the instrument. There is a need to have a calibrating device in the form of a secondary normal incorporated in every apparatus by means of which normal the apparatus can be continuously controlled, e.g., for each measurement of accumulated dust particles, to maintain the normal measuring level. This calibration device was devised which consists of a dust proof sleeve adapted to be located for calibration in the housing of the apparatus in the position assumed by the plate when measuring dust particle accumulation.

41787 **APTIC NO. 64041**

Lindvall, Thomas

MONITORING ODOROUS AIR POLLUTION IN THE FIELD WITH HUMAN OBSERVERS. *Preprint, New York Academy of Sciences, New York, 31p., 1974 (?). 21 refs. (Presented at the Conference on Odors: Evaluation, Utilization, and Control, New York, Oct. 1-3, 1973.)*

The advantages and restrictions of contemporary sensory methods in ambient odor control are discussed as they have been used in Sweden since 1965. The odor pollution level in the ambient air was measured and the effects of odor-reducing measures were studied. Magnitude estimation procedures are especially suitable for ambient air studies when the goal is to quantify the odor strength variations of gas plumes. The method gives a valid measure of odor strength within the specific investigation, although inconsistencies in unit of measurement may presently prohibit settings of absolute limit values in odor control. In the field investigation, the dispersion in data may be considerable and sometimes requires a standardization of response scales. Another drawback with the scaling methods is the difficulty to correct for false responses. This is especially important when visual cues to the observers of what is going to happen cannot be avoided. Standard odorants should be used for purposes of calibration between experiments. This is not only a requirement for future regulations of odor control, but also to enable comparison between laboratories. (Author conclusions modified)

41788 **APTIC NO. 65893**

Lord, H. C.

ABSORPTION SPECTROSCOPY APPLIED TO STATIONARY SOURCE EMISSIONS MONITORING. *Preprint, American Chemical Society, New York, Water, Air, and Waste Div., 17p., 1973. (Presented at the American Chemical Society, Spring National Meeting, 165th, Dallas, Tex., April 8-13, 1973.)*

A heavy-duty, reliable analytical system based on absorption spectroscopy was developed. The hardware can be mounted directly on the stack, dust, or process stream. The light beam passes through the gas stream to provide a continuous, instantaneous, and integrated analysis of the gases. By coupling this in situ mounting with a well-designed analytical capability that provides a specific analysis, the sampling handling and conditioning system can be eliminated. This potentially results in a more accurate and trouble-free operation. The instrumentation is presently monitoring nitric oxide, sulfur dioxide, carbon monoxide, carbon dioxide, hydrocarbons, and opacity in a variety of locations including gas, oil, and coal boilers, steel mills, and refractories. Equipment will be going into refineries and pulp and paper mills in the near future. Data is presented from some of these typical applications.

41789 **APTIC NO. 65927**

Maguire, B. A. and R. P. Abraham

GRAVIMETRIC DUST SAMPLING. NEW INSTRUMENTS FOR USE IN INDUSTRY. *Colliery Guardian (London), 221(2):46-48, Feb. 1973. 16 refs.*

Several dust sampling instruments are described. The SIMPEDS 70 Mk 2 is built into miners cap-lamp and battery assembly. It consists of a cyclone-size-selector/filter unit and a motorized pump. Oversize dust falls to the bottom of the cyclone and is collected in a grit pot for subsequent weighing and analysis. Several new instruments are described.

41790 **APTIC NO. 63772**

Malakhov, V. A. and V. V. Smirnov

TELEVISION COUNTER FOR CLOUD PARTICLES. *(Televizionnyy schetchik oblachnykh chastits). Text in Russian. Inst. Eksp. Meteorol., 38(4):70-93, 1973. 20 refs.*

A high-speed television system with a counter for the determination of concentration and size spectrum of cloud and fog particles is described. A modified closed-circuit industrial television camera with a superorthicon tube and an LI-218 picture tube are used. The particle size is determined by measurement of the vertical dimension of the particles through counting the leading front pulses of the videosignal. The square-mean errors for concentrations of up to 10,000/cu cm and for a size range of 6-12 micron are not greater than 20% and 10-15%, respectively.

41791 **APTIC NO. 63564**

Murtha, P. A.

ERTS RECORD SO2 FUME DAMAGE TO FOREST, WAWA, ONTARIO. *Forestry Chronicle, 49(6), 2p. Dec. 1973. 3 refs.*

Earth Resources Technology Satellite (ERTS) imagery is discussed in terms of mapping and monitoring large forest areas affected by severe sulfur dioxide fume damage, and records are presented for forests in Wawa, Ontario. Band 5 of the ERTS image (red spectral region: 600-700 nm) shows three damage zones (total kill, heavy kill, and medium damage zones) by interpretation of the gray tones (image-density variations) on the black and white positive image. The interpretation is augmented by electronic color enhancement of the density variations, although the light injury zone, recognizable by photo interpretation, can not be delineated on the ERTS image. It is possible with ERTS to draw a line around the perimeter of the medium kill zone. Delineation of damage zones air photo and ERTS imagery interpretation are compared with airborne sketch mapping. Some shifts in areas between adjoining zones are evident among the methods, but since the actual areas of damage are not known exactly, it is impossible to conclude that ony method is more accurate than another. This satellite appears to be the quickest method of mapping and monitoring forest areas affected by SO2 damage.

41792 **APTIC NO. 63966**

Nikiforova, N. K.

PHOTOELECTRIC INSTRUMENTS FOR THE MEASUREMENT OF AEROSOL CONCENTRATIONS AND SIZE DISTRIBUTION FUNCTIONS (A REVIEW). *(Fotoelektricheskiye pribory dlya izmereniya kontsentratsii i funktsii raspredeleniye chastits aerozolya po razmeram* *(obzor)). Text in Russian. Inst. Eksp. Meteorol., 38(4):53-69, 1973. 83 refs.*

A general description is given of photoelectric instruments for aerosol concentration and size distribution studies. Photoelectric instruments are based on the pulse of the scattered light which is characteristic of the given particle and its size, shape, and refractive index. Instruments based on the light-scattering and light-attenuation principles form the two major groups of photoelectric instruments. Instruments adopting the light- attenuation principle have lower sensitivity than light-scattering instruments due to the inherent fluctuations of the current output of their photo receiver. The minimum size measurable by photoelectric instruments is determined by their inherent noise levels. Error can also be caused by differences in the refractive indices of the reference used for calibration, i.e., dioctylphthalate or latex, and of the test aerosol. The concentration of crystalline particles can be determined by measuring the scattering indicatrix of particles of irregular shape, or by measuring the difference in the light scattering as caused by droplets and crystals.

41793 **APTIC NO. 64281**

Nishida, Konosuke, Tsuneo Honda, and Tadao Ando

ODOR TESTER. *(Shukido sokutei sochi ni tsuite) (II). Text in Japanese. Akusku No Kenkyu (Odor Research J., Japan), 2(9): 13-21. 1973.*

A continuous measurement device for determining the degree of odor was constructed. This large, fixed piece of equipment utilizes dilution of odorous gases up to 2000 times to determine threshold. The test gas is pushed under a given air pressure from the flexible bag in the storage tank, and after the flow quantity is regulated by an adjustment valve, mixed with fresh odorless air. The flow rate is between 0.1-1 l/min, and the speed can be adjusted. One to 2 l/min of gas emitted at one time to approximate human respiratory capabilities. From another channel, odorless fresh air is emitted in the same quantity. These emissions are alternated at a cycle of 2 min, with odor 3-6 sec, and odorless air 5-10 sec, at the speed of 1.5 l/min of test odor. This is to prevent the olfactory fatigue of the test personnel. The dilution ratio is automotically recorded, and the pushmarker records the odorless point and the threshold point of the testers automatically. The gas channels are teflon and stainless pipes, and before operating the equipment, heated dry air (60-80 C) is passed through the tubes to eliminate odor. The tester s box has a filter layer of activated carbon at the top and fresh air is constantly supplied. The reliability of the equipment showed a variation of 0.13.3% for the odorless point and 0-9.2% for the threshold. Since this equipment is too heavy and requires too large a space, portable equipment was constructed by eliminating the temperature-humidity control device, and reducing the dilution capacity from 1-2000 to 1-100.

41794 **APTIC NO. 63998**

Ohring, George, Joseph Otterman, and Joachim Joseph

GLOBAL AIR POLLUTION MONITORING FROM SATELLITES: PROSPECTS AND PROBLEMS. *Society of Engineering Science, Pollut. Eng. Sci. Solutions, Proc. Int. Meet. Soc. Eng. Sci., 1st, Tel Aviv, Israel, 1972, p. 54-69, 1973. 40 refs. (June 12-17.)*

Satellite remote sensing is discussed. It can be used to measure various gases (including carbon dioxide, carbon monoxide, nitrogen dioxide, sulfur dioxide, nitrous oxide, methane, and hydrogen sulfide) and aerosols. The observational characteristics of various gases influencing the atmospheric radiation budget and of pollutant gases are discussed. The theory of observation for remote sensing of gases and aerosols is discussed. Problems of remote sensing from space and results of several satellite studies are described. Observations from space are feasible for measurements of vertical profiles of water and ozone, total amounts of most pollutant gases, total aerosols optical depth, and stratospheric minor constituents and pollutants. Observations of vertical profiles of pollutants in the lower troposphere appear extremely difficult. Further research is needed on absorption and scattering properties of pollutants, the distributions and cycles of pollutants, the possibilities of microwave and active sensing techniques, instrumentation for remote observation, and mathematical inversion techniques - especially for aerosols (Author summary modified)

41795 **APTIC NO. 65931**

Perkins, N. M.

DO AIR MONITORING STATION DATA REPRESENT THE SURROUNDING COMMUNITY EXPOSURE? *Intern. J. Biometeorol., 17(1):23-28, 1973. 2 refs. (Presented at the International Biometeorological Congress, 6th, Noordwijk, Netherlands, Sept. 2-9, 1972.)*

The magnitude of measured carbon monoxide concentrations at a monitoring station was compared with concentrations of surrounding areas (Los Angeles County). The temporal pattern and general variations described by the data are in accord. The magnitude of the measurements of the monitoring station was consistently higher than that obtained by measurement of pooled, grab samples. No significant effects of distance were observed in analysis of variance. (Author abstract modified)

41796 **APTIC NO. 65936**

Postema, G. A. and S. Von Heusden

INFRARED EMISSION OF AIR POLLUTANTS INDUCED BY A CO2 LASER. *Int. J. Environ. Anal. Chem., vol. 3:95-100, 1973. 7 refs.*

A possible method for the measurement of air pollutants is described. It is based on infrared emission from gases at specific wavelengths induced by a carbon dioxide laser. The emission level can be increased by adding a sensitizing gas such as sulfur hexafluoride to the sample gas. Although the mechanism of the emission is not fully understood, experimental data indicate that the emission is of thermal origin. In the experiments, the beam of a 55-W CO2 laser was focussed by a concave mirror to a diameter of about 1 mm in front of the entrance slit of a monochromator. A Golay detector and a mechanical chopper at a frequency of 11 Hz were used in conjunction with a synchronous amplifier. Pollutants such as sulfur dioxode, carbon monoxide, nitric oxide, and nitrogen dioxide were added to a nitrogen flow of 60 l/hr, and emission was observed with a focussed laser beam. A minimum laser power was required to observe emission; below 20 W, no emission could be observed. The spectra of these pollutants are given. (Author abstract modified)

41797 **APTIC NO. 64011**

Sadeh, W. Z. and J. F. Ruff

REMOTE SENSING OF POLLUTANTS BY MEANS OF STEREO ANALYSIS. *Society of Engineering Science, Pollut. Eng. Sci. Solutions, Proc. Soc. Int. Meet. Eng. Sci., 1st, Tel Aviv, Israel, 1972, p. 453-468, 1973. 19 refs. (June 12-17.)*

Remote sensing by means of stereo images obtained from flown cameras and scanners provides the potential to monitor the dynamics of pollutant mixing over large areas and permits the efficient monitoring of the pollutant concentration and mixing in sufficient detail. A method of remote sensing using stereo images is described. Preliminary results based on comparison with ground measurements by alternate methods, e.g., remote hot-wire anemometer techniques, support the feasibility of stereo analysis using aerial cameras. Results using the stereo analysis to deduce the three-dimensional extent of visible plumes are presented. An extensive field experimental program was undertaken to demonstrate the feasibility of stereoscopic remote sensing of polluted air masses and of stereo-correlation analysis of stereoscopic images. By and large, standard stereo comparison analysis is limited due to variations in the concentration of pollutants with the plumes, the haze of plumes, and the continuous changing optical backgrounds.

Digital stereoscopic analysis based on correlation techniques possesses the potential to overcome these difficulties. An intensive effort to demonstrate the efficacy of digital stereo correlation is planned. Development of mathematical models for long-term pollution distribution and concentration over large areas depends, to a large extent, on detailed knowledge of both meteorological conditions and polluted air mass features. Stereoscopic techniques can be used efficiently to provide contour maps of pollution including isoconcentration density curves in addition to meteorological parameters. Basically, stereoscopic remote sensing of polluted air masses by flown stereo cameras permits adequate monitoring within large areas at selected time intervals. Furthermore, unpredicted and unexpected pollution can be detected. Consequently, air quality standards and control regulations can be set forth. (Author conclusions modified)

41798 **APTIC NO. 63790**

Sebborn, Walter S.

A ROUTINE METHOD FOR MEASURING THE EFFICIENCY OF FERRIC OXIDE AS AN EXTRACTOR OF HYDROGEN SULPHIDE FROM AIR. *J. Appl. Chem., Biotechnol., 23(12):887-892, 1973. 1 ref.*

Measurement of the absorptive efficiency of ferric oxide is made by passing a measuring volume of air containing a known low concentration of H_2S through the sample at a known constant velocity, and measuring the residual H_2S which has not been extracted. This last measurement is carried out by passing the air through a paper impregnated with silver nitrate, and measuring the optical transmission density of the stain formed. Concentrations are calculated from the sulfide stain densities and the volumes of air passed through the papers. The calibration technique forms the basis of a method of measurement of trace amounts of H_2S in the atmosphere, and is unaffected by the presence of SO_2. (Author abstract)

41799 **APTIC NO. 65873**

Stamulis, A., R. C. Taylor, and V. R. Piatt

THE NRL AIR MONITORING STATION. *Naval Research Lab., Washington, D. C., Radiological and Environmental Protection Staff, NRL-MR-2699, 12p., Dec. 1973.*

The Naval Research Laboratory Air Monitoring Station is described. It was constructed to house instruments necessary for measuring various air pollutants in the ambient atmosphere. The pollutants of interest are sulfur dioxide, ozone, nitrogen dioxide, methane, carbon monoxide, and total hydrocarbons; the meteorological parameters are wind speed and wind direction. The monitoring instruments are automatic, real time, continuous analyzers utilizing the most modern principles of physical and chemical methods of analysis. The instruments analyze air from a continuous flow of air through a 3-inch diameter sampling manifold which projects 8 ft above the roof of the building. The SO_2 is measured with a flame photometric detector, O_3 with a chemiluminescent detector, NO_2 with a colorimetric analyzer, and methane, CO, and total HC with a gas chromatograph using a flame ionization detector. (Author abstract modified)

41800 **APTIC NO. 64194**

Stevens, Don W.

OBTAINING RELIABLE PERFORMANCE FROM HYDROCARBON ANALYZERS. *Preprint, 25p., 1973. 7 refs. (Presented at the Conference on Instrumental Monitoring for Ambient Air, Boulder, Colo., Aug. 1973.)*

A chromatographic technique with hydrogen flame ionization is described for ambient air non-methane hydrocarbon measurements. Total hydrocarbon analysis is first performed by injecting an air sample directly into the flame ionization detector. Air is employed as carrier gas and is supplied through a pressure regulator to a catalytic oxidizer which removes all residual hydrocarbons from the air supply. Hydrogen carrier gas is supplied through a pressure regulating station to a 10-port dual purpose valve for methane and carbon monoxide determination. Methane and carbon monoxide pass from a stripper column into an analysis column where they are resolved for subsequent measurement by the detector. Carbon monoxide which cannot be determined directly by flame ionization detection is first passed through a catalytic methanator which quantitatively converts CO to CH_4. The detector thus provides measurement of three components: total hydrocarbons, CH_4, and CO. Factors affecting performance are reviewed and include: hydrogen supply, air supply, pressure regulators, installation, span calibration, training of operating personnel, and maintenance.

41801 **APTIC NO. 65864**

Villalobos, R.

ROLE OF GAS CHROMATOGRAPHY IN AIR POLLUTION MONITORING. *Preprint, American Chemical Society, 22p., 1973. 16 refs. (Presented at the American Chemical Society, National Meeting, 165th, Dallas, Tex., April 8-13, 1973.)*

The state-of-the-art and recent improvements in ambient carbon monoxide/non-methane-hydrocarbon monitoring gas chromatography are reviewed. A number of other applications in which this chromatograph has been modified and applied are described. The chromatograph is a flame ionization detector. A number of modifications were directed at improving the stability of the molecular sieve columns used for the separation of CO and methane. Sources of contamination were determined and problems were overcome. A number of problems encountered in early field experience caused by impurities in the gases and/or lack of cleanliness of regulator and external connecting tubing were discovered and corrected. Calibration gases were also improved. The chromatograph can be used to measure individual hydrocarbons and CO in ambient and industrial air. It can also can be used in the study of photochemical HC reactions in irradiated smog chambers, in automobile exhaust measurements, in stack gas monitoring, and in measuring dissolved HC in seawater. The chromatograph meets Federal standards for the measurement of non-methane hydrocarbons.

41802 **APTIC NO. 63870**

Watanabe, Ikuo, Toshiichi Okita, and Takeo Suzuki

THE PECULIAR PEAKS ON THE GAS CHROMATOGRAM OF AMBIENT AIR. *(Kankyo taiki no gasu kuromatoguramujo ni mirareru nicchu ni sonzai shi yakan ni shometsu sura piku ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 8(5): 729-737, Dec. 1973. 2 refs.*

In the summer of 1970, a peculiar peak was found on the gas chromatograms of Tokyo ambient air. The peak was present in the day time, but it disappeared at night. For the present, the peak was named peculiar peak A. Ambient air was sampled on the roof of the Institute of Public Health building by a 200 ml glass syringe. Samples were analyzed by gas chromatography within 2 hours. A U-shape trap filled with glass beads was attached to the gas sampling valve on a gas chromatograph. The sampling gas was passed through the trap which was chilled with liquid oxygen. The trap was then brought to 60-80 C by hot water, and its contents simultaneously were swept into the column. The analytical conditions for the gas chromatograph are shown. Effects on the peculiar peak A were researched for sunlight, different sampling syringes, standing time, and sampling method. The results show that peculiar peak A was formed from a slight stain of a syringe with sunlight. Further investigations were undertaken to determine effects of balancing gas, the degree of stain on syringes, and light on peculiar peak A. Peculiar peak A was remarkably influenced by the stain of human fingers, and it was scarcely influenced by balancing gas and the polyethylene chloride tube. The effect of light source was increased in this order: fluorescent lamp, tungsten lamp, blacklight lamp, infrared lamp, and sunlight. The intensity and the wavelength distribution of light were not measured. Some absorbents and adsorbents were the other source of peculiar peak A. Similar peaks to peculiar peak A were found on some syringes, absorbents, and adsorbents. The identification of peculiar peaks was tried from the comparison of retention time and subtractive techniques. The retention data showed that peculiar peak A was not from alcohols, aldehydes or ketones and peculiar peak B was acrolein or acetone. From the results of subtractive techniques, peculiar peak A seemed to be reductant and soluble in water. The magnitude of peak A was shown in the peak height (graduations) on the gas chromatogram chart.

41803 **APTIC NO. 64058**

Williams, Gilbert, Frank W. Hartman, Jr., and George R. Mackey

DIESEL SMOKE ANALYSIS ON A CHASSIS DYNAMOMETER. *Preprint, Society of Automotive Engineers, Inc., New York, 18p., 1973. 15 refs. (Presented at the Society of Automotive Engineers Combined Commercial Vehicle Engineering and Operations and Powerplant Meetings, Chicago, Ill., June 18-22, 1973, Paper 730660.)*

A technique for evaluating the opacity of exhaust smoke from diesel powered vehicles utilizing a chassis dynamometer and light obscuration meter is described. Enactment and enforcement of stringent smoke emission regulations has created the need for a method to determine if the exhaust opacity of in-service vehicles exceeds legal limits as they are driven on the road. This can be accomplished by running a 3 min chassis dynamometer test cycle, which is based upon the Environmental Protection Agency diesel engine certification procedure. Simultaneous recordings of speed and exhaust opacity permit modal analysis for identification of specific malfunctioning components and consequent improved cost effectiveness of maintenance expenditures. (Author abstract modified)

41804 **APTIC NO. 64034**

Wisconsin Univ., Madison, Institute for Environmental Studies

MONITORING AND CONTROL OF REGIONAL AIR POLLUTION: SOUTHEASTERN WISCONSIN. *National Science Foundation Grant GI-29731, Rept. 4, NSF/RA/E-73-010, 95p., April 1973. 30 refs.*

NTIS: PB-227 076

An air quality monitoring and control system for southeastern Wisconsin which is technologically feasible within the current state of the art, but which does not exist and is not being developed has been designed as part of an experimental course in the Institute of Environmental Studies at the University of Wisconsin-Madison. Modifications are proposed to the DNR s weather watch system to provide better meteorological data for the proposed monitoring and modeling systems. It appears that the Wisconsin Dept. of Natural Resources has successfully compiled with the Environmental Protection Agency s regulations. The system included provisions for monitoring the effects of air pollution on public health. The system has been designed so that it is complete, i.e., provided that conditions are favorable, its implementation will require no further inputs or considerations. While new sensing techniques are suggested, these are feasible within present technology. In addition, economic aspects of implementation have been worked out in terms of money available to DNR under its implementation plan.

1972

41805 **APTIC NO. 64164**

Ciosek, Aleksandra

THE USEFULNESS OF POLEZHAYEV S METHOD FOR THE DETERMINATION OF MERCURY VAPORS IN THE AIR. *(Przydatnosc metody Polezajewa do oznaczania stezen par rteci w powietrzu). Text in Polish. Med. Pracy. (Warsaw), 23(1):83-90, 1972.*

The simplest and easiest method for the determination of mercury vapors in the air is Polezhayev s. It is based on combining mercur with iodine in a solution of potassium iodide and reduction by copper salts. The intensity of the sediment coloring indicates the quantity of mercury absorbed from the air. Eight variants of Polezhayev s method were studied and the causes affecting the sensitivity and precision of the measurements were analyzed. The best method mercury concentrations of at least 0.01 mg/cu m with an accuracy not exceeding + or - 20% was chosen. In order to determine the mercury concentration in the air, it is necessary to sample 60 l of air. A 1000 cu cm flask is used for a solution of 30 g potassium iodide in a small amount of distilled water, to which 2.5 g iodine are added. Mercury chloride is dissolved in 1 cu cm of absorbent solution. The cu cm of the solution is diluted 100 times in the absorbent solution. Three cu cm absorbing solutio are put into two Zaytsev s gas purifiers with 60 cu cm of air at a velocity of 120 to 180 cu cm/hr. Into 6 colorimetric tubes, 0.2; 0.3; 0.4; 0.6; 0.8; and 1.0 cu cm of sampling solution are introduced, corresponding to 0.1 to 1 microgram of mercury.

41806 **APTIC NO. 64065**

Eichmeier, Joseph

ATMOSPHERIC POLLUTION METER. *(Vorrichtung zur Messung der Luftverschmutzung). Text in German. (Berckheim, Constantin Graf von Weinheim (Germany)) W. Ger. Pat. Appl. 2,261,792. 3p., Dec. 16, 1972. (6 claims).*

An atmospheric pollution meter has an instrument to generate an output signal dependent on the concentration of small positive or negative ions so designed that only ions of the same sign contribute to the output signal, and has a second instrument generating a second output signal dependent on the concentration of heavy ions of the same signs. A circuit which derives a signal proportional to the ratio of these two output signals generates the final output measurement signal.

41807 **APTIC NO. 63422**

Florance, E. T.

ONR PROGRAMS RELATED TO AIR QUALITY INSTRUMENTATION. *Naval Civil Engineering Lab., Port Hueneme, Calif., Proc. Nav. Environ. Prot. Data Base Instrum. Workshop, Port Hueneme, Calif., 1972, p. 210-222. (July 11-12.)*

NTIS, DDC: AD-772547

Programs under the Office of Naval Research which relate to air pollution research and the development of air monitoring instrumentation are reviewed. Meteorological instrumentation for atmospheric profiling is discussed, and problems of statistical and mathematical data analysis are considered. State-of-the-art research efforts concerning X-ray fluorescence, infrared spectrometry, ion-mobility spectrometry, and condensation nuclei counters are briefly reviewed. Remote sensing is discussed in more depth.

41808 **APTIC NO. 63423**

Gorin, Nathaniel H.

THE NAVAL SHIP ENGINEERING CENTER, PHILADELPHIA DIVISION SOURCE EMISSION MONITOR. *Naval Civil Engineering Lab., Port Hueneme, Calif., Proc. Nav. Environ. Prot. Data Base Instrum. Workshop, Port Hueneme, Calif., 1972, p. 223-240. 8 refs. (July 11-12.)*

NTIS, DDC: AD-772547

The measurement of source emissions from steam generators by the Naval Ship Engineering Center, Philadelphia Division is described. The general sample flow schematic and measurement methods for the monitoring instrumentation are illustrated. Sulfur dioxide, nitrogen oxides, carbon monoxide, hydrocarbons, carbon dioxide, oxygen, and smoke can be measured by the Source Emission Monitor; particulates are not. The smoke values are only an indirect measure of particulates in stack gas, larger quantities indicate poor combustion practice.

41809 **APTIC NO. 64067**

Hofmann, Kurt

EXHAUST GAS ANALYSIS INSTRUMENT. *(Dosireinrichtung fuer ein Gas-oder Fluessigkeits-Analysengeraet). Text in German. (Hartmann and Braun AG, Frankfurt (Germany)) W. Ger. Pat. Appl. 2,044,772. 4p., March 16, 1972. (5 claims).*

An exhaust gas analysis instrument uses a capillary with one end projecting into the gas undergoing determination. To achieve constant sampling, the static pressure at the entrance to the capillary is kept constant by means of an ancillary flow above it. The capillary is preferably wound around a sealed hollow cylinder, with its ends leading into it. The cylinder is then placed inside a metal housing with channels through which the test gas is fed in and out, so that the capillary ends project into the channels.

41810 **APTIC NO. 63860**

Ikebe, Yukimasa

MEASUREMENT OF SUBMICRON PARTICLE SIZE DISTRIBUTION BY THE STATIC METHOD, I: ANALYTICAL METHOD. *(Static hoshiki ni yoru sabumikuron ryushi no syukei bunpu sokutei (I)). Text in Japanese. Taiki Denki Kenkyu (Proc. Soc. Atmos. Electr. Jap.), no. 7:7-10, Aug. 1972. 4 refs.*

The static method of submicron particle average size distribution was examined in comparison to the dynamic method of particle distribution determination by passing the particles through a battery and checking the response decrease in particle number. The methods were applied in actual measurements. The advantage of the static method is that it does not require adjustment of the flow quantity as in the dynamic method. The quality of response range is also better than that can obtained from the dynamic method, and it does not require controlling of fluctuations.

41811 **APTIC NO. 63840**

Katou, Tatsuo

GAS CHROMATOGRAPHIC ANALYSIS OF AMINES IN THE AIR BY THE REACTOR TUBE METHOD. *(Dantai hannokan o mochiiru taikichu aminrui no gasu kuromatogurafu bunseki). Text in Japanese. Yokohama Kokuritsu Daigaku Kogakubu Kikai Kiso Kogaku Kenkyu (Yokohama Natl. Univ. School Eng., J. Mech. Eng.), no. 7:33-47, 1972.*

The reactor tube method is a newly developed, simple and efficient sample collection method for gas chromatographic analysis. In this method, samples are captured selectively on the solid reagent by chemical reactions, and recovered from the solid reagent by decomposition. A gaseous mixture is passed through a glass tube packed with glass beads coated uniformly with reagents, and samples captured on glass beads are recovered by the subsequent decomposition reaction. For amines, the glass bead (15-28 mesh) was coated with a mixture of 1.0 wt% of oxalic acid and 0.15% glycerine. The amines captured were recovered by decomposing with an alkali solution (potassium hydroxide). Other organic acids were tested, but oxalic acid was found to be most effective for amines. The effects of sorption concentration of reagent, amount of glass beads, and flow rate of gaseous mixture were examined to find optimum conditions. The capture rates for 10 lower amines were measured, and certain correlations were found between the chemical structure and capture rate. The decomposition procedure, effect of the type and concentration of decomposition agent, decomposition temperature and decomposition time were evaluated. The type of filler for reactor tube and tube diameter were also examined. The selection of chromatographic column for the separation of amines and other gas chromatographic analysis conditions are discussed. The sufficiently high selective capturing rate of samples and the simplicity of the procedure make this method useful for environmental amine analysis.

41812 **APTIC NO. 63418**

Knapp, Kenneth T.

MONITORING AIR POLLUTANTS IN THE AMBIENT AIR. *Naval Civil Engineering Lab., Port Hueneme, Calif., Proc. Nav. Environ. Prot. Data Base Instrum. Workshop, Port Hueneme, Calif., 1972, p. 160- 162. 4 refs. (July 11-12.)*

NTIS, DDC: AD-772547

Instruments and methods for monitoring air pollutants in the ambient air used by the National Air Sampling Network (NASN) are summarized. Currently only sulfur dioxide and nitrogen dioxide are monitored by collecting 24-hour integrated samples by passing a known amount of ambient air through a solution by means of an appropriate gas dispersing device. Nitrogen dioxide is either measured by the Jacobs-Hochheiser (J-H) method or a method that adds sodium arsenite to the basic J-H solution. Total oxidants and ozone are measured by continuous monitoring instruments. There are several carbon monoxide monitors, but they do not give quantitative results and/or are not reliable at ambient CO concentrations. The flame ionization detector is used to monitor airborne hydrocarbons. There are several instruments for the various nitrogen oxides, but they are very costly. Total suspended particulate matter is currently collected by filtration. There are instruments for monitoring airborne mercury and prototype instruments for cadmium and lead. The trend in air monitoring appears to be toward continuous monitoring, but economic factors will preclude their universal application. The immediate outlook for measuring gaseous pollutants is good, while reliable continuous total suspended particulate matter and metal instruments appear to be several years away.

41813 **APTIC NO. 63420**

Krimmel, J. A. and Y. M. Martinez

PILOT TEST INSTRUMENTATION FOR EMISSIONS FROM GAS TURBINE ENGINE TEST CELLS. *Naval Civil Engineering Lab., Port Hueneme, Calif., Proc. Nav. Environ. Prot. Data Base Instrum. Workshop, Port Hueneme, Calif., 1972, p. 182-185. (July 11-12.)*

NTIS, DDC: AD-772547

Pilot tests on emissions from gas turbine engine test cells were conducted to establish a method of monitoring to be used at various testing facilities during the fiscal year 1973 and beyond. The instruments for the measurement of gasoues emissions included nondispersive infrared analyzers for carbon monoxide and carbon dioxide, chemiluminescence for nitrogen oxides, flame ionization detector for total hydrocarbons, and polarographic methods for oxygen. All data were obtained during normal test cell engine operation with the exception of occasional short deviations to accommodate the collection of data at certain engine settings. The results are tabulated.

41814 **APTIC NO. 63419**

Lindenhofen, H. E. Jr. and G. Speck

JET AIRCRAFT ENGINES EMISSIONS MEASUREMENT TECHNIQUES AND ASSOCIATED PROBLEMS. *Naval Civil Engineering Lab., Port Hueneme, Calif., Proc. Nav. Environ. Prot. Data Base Instrum. Workshop, Port Hueneme, Calif., 1972, p. 165-181. 8 refs. (July 11-12.)*

NTIS, DDC: AD-772547

Techniques for aircraft gas turbine engine pollution measurements are discussed including the procedure, problem areas, and recommended investigations aimed at improving the method. The gaseous emission measurement system (ARP 1256) consists of a hydrocarbon analyzer utilizing the flame ionization method of detection; non-dispersive infrared analyzers used to measure carbon monoxide, carbon dioxide, and nitric oxide; and a chemiluminescent analyzer used to measure nitrogen oxides and NO. A schematic of the sampling scheme used to measure smoke from gas turbine engines is illustrated. Recommendations for future work include: development of particulate measurement techniques; work on the repeatability and reproducibility of gas turbine exhaust gas measurement techniques; improved sampling methods for turbofan engines; the effect of ambient conditions on exhaust gas emission levels; comparison of NDIR and chemiluminescent instruments in measuring low levels of NO in exhaust gases; and the development of a light transmission device for measuring gas turbine engine smoke density.

41815 **APTIC NO. 63421**

Liukonen, Larry R.

SOURCE SAMPLING HOSPITAL PATHOLOGICAL INCINERATORS. *Naval Civil Engineering Lab., Port Hueneme, Calif., Proc. Nav. Environ. Prot. Data Base Instrum. Workshop, Port Hueneme, Calif., 1972, p. 206-209. (July 11-12.)*

NTIS, DDC: AD-772547

Techniques and tests used in source sampling hospital pathological incinerators are discussed. Alundum and stainless steel thimbles are used as filters in the sampling train. They are placed directly in the stack which negates the requirement for a heated probe to prevent moisture condensation and also removes the need to wash particles out of the probe. A Buell Engineering Calibrated Orifice was used in the train to provide an instantaneous check on flow rate. Differential pressure across the orifice is measured with a magnehelic gauge. Portable Bacharach Fyrite Gas Analyzers were used to measure oxygen and carbon dioxide.

41816 **APTIC NO. 63417**

McNesby, J. R.

AIR POLLUTION MONITORING INSTRUMENTATION. *Naval Civil Engineering Lab., Port Hueneme, Calif., Proc. Nav. Environ. Prot. Data Base Instrum. Workshop, Port Hueneme, Calif., 1972, p. 150-155. (July 11-12.)*

NTIS, DDC: AD-772547

Air pollution monitoring instrumentation is discussed and the current methods of ambient and source air pollutant monitoring are reviewed. Effective air quality implementation must include measurement of stack emissions, auto exhaust emissions, and ambient air pollutant concentrations by an internally consistent measurement system. The most direct approach to this problem is to establish absolute accuracy in measurement. This requires completely evaluated measurement methods that are interference free and rapid enough to detect diurnal variation. The National Bureau of Standards is attempting to provide standard reference materials such as the sulfur dioxide permeation tube. Future plans include standard gases for calibrating stack and auto emissions monitors. National ambient standards (legal limits) are set for six specific pollutants: SO2, CO, nitrogen oxides, photochemical oxidants, nonmethane hydrocarbons, and particulate matter. The accurate determination of these constituents the primary measurement problem. These pollutants are encountered in ambient air and under vastly different conditions at their sources. Current measuring methods for them are summarized.

41817 **APTIC NO. 64090**

Moser, E.

MEASURING INSTRUMENTS FOR DETERMINATION OF FLUORIDE IMISSIONS. *Fluoride, 5(2):84-85, April 1972. (Presented at the International Society of Fluoride Research, The Hague, Netherlands, Oct. 24-27, 1971.)*

Damage from gaseous fluorides such as hydrogen fluoride differs from that due to particulate fluoride. In evaluating fluoride damage to plants, the fluoride content of dust is relatively insignificant. In animals, fluoride absorption depends largely upon the solubility of the compound. An instrument is described for separating particulates from gaseous fluoride for use in determining the relative effects of the two types of fluoride. The instrument consists of a heated membrane filter. The sample is heated to avoid condensation of HF. The HF is absorbed either by an impinger or by an absorption tube with sodium hydroxide-loaded silver balls or bead spheres. The tested volume of air is about 2 cu m/hr. The method gives reproducible results. (Author abstract modified)

41818 **APTIC NO. 64060**

Strange, John Phillip, Stanley Peter Nebash, Alexander
Crawford McInnes, and Paul Willis McConnaughey

DUST ANALYSER FILTRATION UNIT. *(Filtereinheit). Text in German. (Mine Safety Appliances Co., Pittsburgh, Pa.) W. Ger. Pat. Appl. 2,154,962. 4p., June 8, 1972. (4 claims).*

The filtration unit is for determining dust particles by weight in a given volume of air flow. The lower half of the cassette holding the filter has an inlet for the filtration medium and the upper half an outlet. The lower cassette section is in the shape of a truncated cone, as is the filter insert which it holds. The edge of the frame of the filter insert acts as a flange to the filtration disc and its associated porous cover and has a slot to facilitate removal of the insert from the unit. To prevent dust collected in the insert from falling out of the lower inlet when the insert is removed, it arches inwards at this point. The two cassette sections are held together by a sealing band.

41819 **APTIC NO. 63558**

Yakowitz H., M. H. Jacobs, and P. D. Hunneyball

ANALYSIS OF URBAN PARTICULATES BY MEANS OF COMBINED ELECTRON MICROSCOPY AND X-RAY MICROANALYSIS. *Micron, vol. 3:498-505, 1972. 6 refs.*

Four samples of urban particulate matter were analyzed by combined electron microscopy and X-ray microanalysis. Lead was present only in particles ranging from 0.05 micron to about 0.3 micron in one of the samples collected and did not seem to associate with other particles. Analysis of a fly ash specimen showed no qualitative or significant quantitative variation in chemistry as a function of size for the most prevalent type of particle found. Major constituents of some small particles in a composite dust sampled were silicon, calcium, aluminum, and iron. The combined electron microscopic and microanalytical method is suggested as being a valuable tool to be included with other methods for particulate analysis. (Author abstract modified)

41820 **APTIC NO. 63525**

Yavorovskaya, S.

GAS CHROMATOGRAPHY--A METHOD OF DETERMINING HARMFUL SUBSTANCES IN THE AIR AND IN BIOLOGICAL MEDIA. *(Gazovaya Khromatografiya--Metod Opredeleniya Vrendnykh Veshchestv v Vozdukhe i v Biologicheskikh Sredakh). Moscow, Meditsina Publishing House, 1972, 206p., 105 refs. Translated from Russian. Joint Publications Research Service, Arlington, Va., 220p., Aug. 1973.*

NTIS: JPRS-59872

Gas chromatography is reviewed as a method of determining harmful substances in the air and in biological media. The main attention is given to methods of preparing standard concentrations of analyzed mixtures and on methods of taking samples with and without concentration of trace impurities. A brief account of publicatons in the Soviet and foreign literatury on the gas chromatographic determination of traces of harmful substances in the air and biological media. In the air determinations are made of aggressive and non-aggressive gases, hydrocarbons, solvent vapors, chlorinated and fluorinated organic compounds, aldehydes, ketones and alcohols, compounds containing nitrogen, and carcinogens. Narcotic substances, alcohols, drugs, amines, and metals are determined in biological media. (Author summary modified)

1971

41821 **APTIC NO. 65890**

Easley, Wesley C.

DEVELOPMENT OF A FORMALDEHYDE DETECTOR USING A SMALL MICROWAVE RESONANT STARK CELL. *Preprint, National Aeronautics and Space Administration, 18p., 1971 (?). 7 refs.*

A breadboard instrument for detection of relatively low concentrations of formaldehyde was constructed and tested in a laboratory. This improved instrument uses a microwave spectral absorption in a low Q resonant Stark cell made from a short length of Ku-band waveguide with reflectors placed at each end. Stark modulation is then utilized, in conjunction with a lock-in amplifier, for detection. A Gunn oscillator is used for the microwave source. The source is tuned to 28974.81 MHz, the frequency of a strong formaldehyde absorption line in the Ka-band. A continuous sample flow is maintained through the absorption cell, and the formaldehyde sample is concentrated before entering the cell by means of a dimethyl silicone membrane. Experimental results indicate that the ultimate sensitivity of the instrument is on part in 10 to the 7th power of formaldehyde. (Author summary modified)

41822 **APTIC NO. 63631**

Funkhouser, J. T.

APPLICATION OF MICROWAVE SPECTROMETRY TO THE MONITORING OF STATIONARY SOURCES. *Preprint, American Inst. of Chemical Engineers, New York, 11p., 1971. (Presented at the American Institute of Chemical Engineers, National Meeting, 68th, Houston, Tex., Feb. 28-March 4, 1971, Paper 68a.)*

Microwave spectrometry involves measuring arising from rotational transitions of entire molecules. It can be used to directly monitor nitrogen dioxide in fossil fuel combustion emissions or nitric acid plant emissions. Nitric oxide, carbon monoxide, hydrogen sulfide, hydrogen chloride, sulfur dioxide, methanol, methyl chloride, and other compounds can also be measured. Spectral characteristics of methanol and calibration curves for 0.13% methyl chloride in nitrogen are discussed in some detail.

41823 **APTIC NO. 64120**

Hryniewicz, R.

MODIFIED CONTACT METHOD FOR THE DETERMINATION OF SULFUR DIOXIDE IN THE ATMOSPHERE. *(Zmodyfikowana kontaktowa metoda oznaczania dwutlenku siarki w atmosferze). Air Conserv. (English translation from Polish of: Ochrona Powietrza), 5(2):36-41, 1971. 5 refs.*

NTIS: TT 72-54022/2

A method is described for adapting the Huey method of determining sulfur dioxide air pollution with lead peroxide to Polish conditions. The lead peroxide surface prepared for exposure to the atmosphere is about 20 sq cm in area, about 1/5 of that in the traditional lead candles. It is deposited on a disc and exposed with the peroxide-covered surface facing down. The lead plate is exposed for 24 hr, and the sulfate ion concentration is determined nephelometrically. A reference table is presented for estimates of sulfur dioxide in terms of sulfate/100 sq cm/24 hr. Results are given of sulfur dioxide in terms of sulfate/100 sq cm/24 hr. Results are given of field tests of the mean SO2 concentration in Warsaw-Bielany air. The contact method may be more useful than other methods in investigations of the effects of SO2 on buildings, construction, and so on.

41824 **APTIC NO. 64109**

Kasprzycki, A.

MEASUREMENTS OF THE CONCENTRATION OF DUST IN THE ATMOSPHERE. *(Pomiary stezenia zapylenia atmosfery). Air Conserv. (English translation from Polish of: Ochrona Powietrza), 5(5):1-9, 1971. 2 refs.*

NTIS: TT 72-54022/5

Absolute and relative methods of measuring the concentration of dust in the atmosphere are presented. The relative method used is a reflectometric method based on photometric evaluation of the degree of soiling of a Whatman filter paper. The absolute method consists of sampling with a membrane filter and measurement by gravimetry. Results of measurements obtained with both methods are discussed. When the results from the two methods are compared, accuracy exceeds 75%. The reflectometric method is useful in many cases, depending on meteorological purposes. It is not suitable for analysis of high concentrations of dust. Only results obtained at the same measuring point over a period of time may be compared with the method. Reflectometry is not suitable for a detailed comparison of results obtained in the same period of time at various measuring points. When it is necessary to apply the relative method, a comparison with the absolute method is necessary to eliminate bias and to determine statistically the accuracy of measurements.

41825 **APTIC NO. 64141**

Krzysztofik, B.

METHODS OF DETERMINATION OF MICROBIAL CONTAMINATION OF AIR. *(Metody ustalania stopnia mikrobiologicznego zanieczyszczenia powietrza). Air Conserv. (English translation from Polish of: Ochrona Powietrza), 5(3):42-53, 1971. 29 refs.*

NTIS: TT 72-54022/3

A historical review is given of methods of sampling the air for determination of bacteriological contamination of air. A detailed description is given of devices now used in the Department of Sanitary Biology of the Warsaw Technical University. Methods for the determination of bacteriological contamination which are discussed include: sedimentation; filtration using filters with a solid filtering medium and using filters with a liquid filtering medium; atomization; impingement which includes centrifugal and common impaction methods; and electric precipitation.

41826 **APTIC NO. 64140**

Masek, V.

DETERMINATION OF THE LOWER ALIPHATIC ALDEHYDES CONTENT IN THE ATMOSPHERE. *(Oznaczanie zawartosci maloczasteczkowych aldehydow alifatycznych w powietrzu). Air Conserv. (English translation from Polish of: Ochrona Powietrza), 5(3):21-31, 1971. 27 refs.*

NTIS: TT 72-54022/3

Methods of mass spectrometry and infrared spectral analysis are unsuitable for determination of aliphatic aldehydes in the atmospheric air because the methods are of inadequate sensitivity and selectivity for the minute quantities of aldehydes occurring in the air. Colorimetric techniques have gained wide acceptance instead, followed by titrimetric, polarographic, and chromatographic methods. Individual methods and their accuracy are discussed. The formaldehyde, acetaldehyde, and acrolein contents in the air of variuos industries and urban areas are discussed, and methods for determination of these and other aldehydes are discussed.

41827 **APTIC NO. 64126**

Radzimirski, S.

METHODS OF TESTING EMISSION OF NOXIOUS COMPONENTS FROM EXHAUST SYSTEM OF MOTOR VEHICLES. *(Metody kontroli emisji skladnikow szkodliwych z ukladu wydechowego samochodow). Air conserv. (English translation from Polish of: Ochrona Powietrza), 5(2):9-19, 1971. 3 refs.*

NTIS: TT 72-54022/2

American, Japanese, and European methods of testing the emission of carbon monoxide and hydrocarbons by motor vehicles are described. The differences between the engine operating cycles and measurement methods recommended by particular standards are stressed. Calculations are given of carbon monoxide, hydrocarbons, and carbon dioxide according to the American method. Engine operating cycles envisaged by the several standards differ considerably in the time percentages accounted for by the various operations in the cycle, in the magnitude of acceleration, and in use of the gear box. In the European cycle, idling is assigned a higher time percentage, and the use of low gears is more frequent than in the American cycle. This shows that urban traffic conditions are much more difficult in Europe than in the U. S. In the Japanese cycle, noxious components are measured for only a small percentage of the duration of the whole cycle. The usefulness of restricting the emission of hydrocarbons and carbon monoxide emissions is discussed.

41828 **APTIC NO. 61073**

Sansoni, B. and W. Kracke

RAPID DETERMINATION OF VERY LOW ALPHA AND BETA ACTIVITIES IN BIOLOGICAL MATERIAL AFTER WET ASHING WITH OH RADICALS. *(Schnelle bestimmung sehr niedriger alpha- und beta-aktivitaeten in biologischem material nach nassveraschung mit OH radikalen). International Atomic Energy Organization Contract 770/RB, Rept. IAEA-SM-148/57, 1971 (?). 22 refs. Translated from German, 24p.*

A method is described for the rapid determination of very low alpha and beta activities in biological material after wet ashing with hydroxy radicals. The method used rapid dissolution of the organic material by Fenton s reagent, hydrogen peroxide/bivalent iron without complete ashing, radio-chemical concentration and separation by ion exchange, and beta measurement or alpha spectrometry. The method is particularly suitable for such biological materials as meat, fish, blood, meal, feces, urine, vegetation, cellulose, and cation exchange resins. (Author abstract modified)

41829 **APTIC NO. 63588**

Vinogradov, B. V.

MAN-MADE ENVIRONMENT AS VIEWED FROM SPACE: WATER AND AIR POLLUTION. *Preprint, 16p., 1971. 20 refs. (Presented at the International Astronautical Federation Congress, Brussels, Belgium, Sept. 1971.) Translated from Russian. National Aeronautics and Space Administration, Washington, D. C., NASA-TT-F-14079, 18p., Nov. 1971.*

NTIS: N72-12322

Space sensors can be used to derive information about almost all forms of manmade pollution of the environment. Global pollution effects should be studied by a wide international program of observation. A global study can be realized only on the basis of space methods whose application is beyond the state and regional boundaries. Space methods can be applied to both air and water pollution. These methods are reviewed. Space methods can be used to measure industrial smoke, solid particles due to wind erosion, fires, jet aircraft streams, and smoke plumes. The results of several space measurements are reviewed.

41830 **APTIC NO. 65895**

White, R. K.

ANALYTICAL AND ORGANOLEPTIC MEASUREMENT OF ODOURS FROM ANIMAL WASTES. *p. 105-109, 1971 (?). 14 refs. (No further citation information is available.)*

The control and abatement of odors requires correlating subjective evaluations by organoleptic or sensory measurements with objective analyses from qualitative and quantitative measurements. Equipment and techniques developed for representative sampling of odors at ambient temperatures, for analytical measurement of odorants using gas chromatography, and for organoleptic evaluations are described. A representative sampling technique uses packed bed samplers which collect odorants in proportion to their concentration. After the sample is collected at ambient conditions it is transferred to a cryogenic trapping device for injection into a gas chromatograph. Injection is performed mechanically to assure repeatability. A stream splitter in the gas chromatograph, separating part of the sample for sensory evaluation, enables analytical and organoleptic measurements to be made for the same fraction. A correlation of analytical and organoleptic measurements was obtained. Improvements of existing equipment for sampling, injection, and analysis of odors are presented. New and improved techniques including panel studies on odor intensities, for both field and laboratory samples, are discussed. (Author abstract modified)

41831 **APTIC NO. 63582**

Zoerner, Karl-Heinz

SINGLE-BEAM INFRARED GAS ANALYZER. *(Verfahren und Vorrichtung zur Funktionskontrolle und Nacheichung von nichtdispersiven Einstrahl-Ultrarot-Gasanalysengeraeten mit Doppelschichtemfaenger). Text in German. (Maihak, AG, Hamburg (Germany)) W. Ger. Pat. Appl. 1,648,984. 2p., July 29, 1971. (4 claims).*

A procedure for the control and recalibration of nondispersive single-beam IR gas analyzers with double-layer receiver and pulsed IR source is described. Function control and recalibration are done by superimposing a constant-intensity radiation component on the pulsed radiation to produce a simulated measuring signal. The simulated measuring signal thus obtained, being dependent solely on the IR source emission, the optic transmissivity of the cuvette, the sensitivity of the absorption measuring chamber, and the amplification in the electronic unit, can be used for the control of nondispersive single-beam IR gas analyzers.

1970

41832 **APTIC NO. 64029**

Andreyev, B. G.

TOTAL SPECTRUM OF PARTICLES OF NATURAL AEROSOLS: ESTIMATE OF THE PORTION OF ACTIVE CONDENSATION NUCLEI. *(Tr. Vses. Konf. Fiz. Oblakov Aktiv. Vozdeist., vol. 8:93-100, 1970. 6 refs. Translated from Russian by Victor Mesenzeff, Foreign Technology Div., Wright Patterson AFB, Ohio, Translation Div., FTD-HT- 23-65-74, AR2031575, 10p., Sept. 1973.*

NTIS, DDC: AD 768 462

The total spectrum of particles of natural aerosols is described and the portion of active condensation nuclei is estimated. Few measurements have been made of the total spectrum of particle size distribution. The numerous measurements of particle size and their concentrations in isolated regions of the total spectrum have a limited value since, quite often, the area to be measured is not clearly defined. The greatest difficulty is encountered in studying highly dispersed aerosols having a particle size of less than 1 micron in diameter. An indirect method based on the relationship between the electrical characteristics of particles and their sizes was used to obtain a general spectrum of particle distribution by sizes. A picture of total spectra of the sizes of natural aerosols, averaged from several hundred measurements carried out in Central Asia is presented.

41833 **APTIC NO. 64072**

Binek, Bedrich, Sieglinde Przyborowski geb. Vonend, and Werner Ullman

SCINTILLATION ANALYSIS OF GAS-SUSPENDED PARTICLES. *(Verfahren und Vorrichtung zur Analyse von dispersen Systemen). Text in German.*

(Ceskoslovenska akademie ved, Prague (Czechoslovakia)) W. Ger. Pat. Appl. 1,598,288. 4p., Dec. 17, 1970. (2 claims).

A method of analyzing dispersed systems comprising atomized particles floating in a gas consists of heating the particles to a temperature at which they emit light flashes and then analyzing these flashes to establish from the characteristic spectral range the nature of the particles. Before the particles are heated, the concentration of particles in the gas is reduced by diluting the gas with a particle-free gas, so that the particles can be individually and successively heated for study.

41834 **APTIC NO. 63455**

Dunson, J. B., Jr.

DUST COLLECTOR PERFORMANCE EVALUATION BY MIDGET IMPINGER AND COULTER COUNTER. *Preprint, American Inst. of Chemical Engineers, New York, 35p., 1970. 15 refs. (Presented at the American Institute of Chemical Engineers, Annual Meeting, 63rd, Chicago, Ill., Nov. 29-Dec. 3, 1970, Paper 5e.)*

Design of economical equipment for collecting solid particles much smaller than 10 micron from large process gas flows requires prediction of measurement of the particle size distribution. One economical measurement method is the midget impinger sampler method to prepare dispersions suitable for direct examination with a Coulter Counter. Results of an equipment evaluation test are given to illustrate the use of the method for measuring fractional collection efficiency. (Author abstract)

41835 **APTIC NO. 64086**

Lieberman, A.

USE OF CONTINUOUS PARTICLE MONITORING SYSTEMS IN SIMPLE ENVIRONMENTAL CONTROL LOOPS. *Preprint, American Inst. of Chemical Engineers, New York, 7p., 1970. (Presented at the American Institute of Chemical Engineers, Annual Meeting, 63rd, Chicago, Ill., Nov. 29-Dec. 3, 1970, Paper 5b.)*

Controlled environments encompass the range from a single machine which may contain critical components that can be damaged by its own wear products to an air basin containing one or more pollutant sources. In all cases, a continuous particle monitoring system with an analog output contains the input elements for the necessary control loop. Both off and on, the proportional control can be obtained for activation of remedial systems. Some typical applications are described where the use of a continuously operating rate-indicating particle monitor has been of value. Design and performance data are given for particle monitoring systems including one that employs a continuous calibrator and automatic gain control to permit long-term, untended operation in remote or otherwise difficult locations. (Author abstract)

41836 **APTIC NO. 64107**

Reagan, J. A., B. M. Herman, and R. J. Spiegel

ON THE USE OF BISTATIC LIDAR IN THE STUDY OF ATMOSPHERIC AEROSOLS. *Inst. of Electrical and Electronic Engineers, Southwest. Inst. Electr. Electron. Engrs. Annu. Conf., Dallas, Tex., 1970, p. 526-530. 16 refs. (April 22-24.)*

The basic lidar (laser radar) detection technique is described briefly, and a discussion is given on the possibility of using bistatic lidar to determine the size distribution of atmospheric aerosols. Theoretical scattering calculations are presented which indicate that measurements of the polarization parameters (ellipticity and degree of polarization) of laser light scattered by aerosols should provide considerable information about the nature of the aerosol size distribution. Under the assumption that atmospheric aerosols was characterized by a Junge size distribution model, the unknown size distribution parameter may be estimated quite accurately from simulated measurements of the polarization parameters which include realistic noise contributions. A brief discussion is given on the interesting features of a unique bistatic lidar system recently constructed for the purpose of studying atmospheric aerosols. (Author abstract)

41837 **APTIC NO. 64061**

Stumpp, Gerhard

ENGINE EXHAUST GAS MONITORING DEVICE. *(Vorrichtung zum Messen der Konzentration von in einem stroemenden Gas suspendierten Teilchen, insbesondere des Russgehaltes der Abgase von Brennkraftmaschinen). Text in German. (Bosch, Robert GmbH, Stuttgart (Germany)) W. Ger. Pat. Appl. 1,498,138. 3p., Oct. 22, 1970. (3 claims).*

The device has a light source, a measuring tube carrying gaseous suspension, and a photo-electric receiver in tubus. The tubus connects to a measuring tube by means of a bushing which screws against the measuring tube it encloses and swivels vertically to the axis of suspension flow. The bushing has a connecting inlet and two other openings. The first swivel position of the tubus is for gauging. The receiver is exposed to light passing through openings of the measuring tube in the beam axis. In the second position for zero balance, the receiver is screened against any light and in the third position for measuring, the receiver is exposed to light reflected through the third opening.

1969

41838 **APTIC NO. 64290**

Ogorodnikov, B. I., V. I. Skitovich, and E. A. Sitalo

FILTERING AEROSOLS WITH NATURAL ATMOSPHERIC RADIOACTIVITY THROUGH FIBROUS MATERIALS. *Main Administration of the Hydrometeorological Service (U.S.S.R.), Inst. of Experimental Meteorology, Proc. All-Union Conf. Nucl. Meteorol., Obninsk, U.S.S.R., 1969, p. 245-254. 16 refs. (June 23-28.) Translated from Russian. Israel Program of Scientific Translations, Jerusalem, 1974.*

NTIS: TT 7450011

At a filtration rate of about 150 cm/sec, FFP-15 and FPA-15 materials have approximately the same efficiency, but the former is more effective at a rate of about 1 to 10 cm/sec owing to the presence of electrostatic charges on its fibers. The FP material is suitable for use in the upper atmosphere, as its efficiency in trapping aerosols of all sizes increases. For instance, the efficiency of FPA-15 material in trapping aerosols of about 0.035 micron particle radius at filtration rates of 1 to 65 cm/sec is approximately 10 to 12 times as high at 27 km as at ground level. A study of radioactivity distribution over the layers of the filtering material has shown that particles of that size account for 40 to 60% of the radioactivity of radon daughter products in the ground layer of the atmosphere. Filtering by EP was studied experimentally with air containing coarse aerosols (1 to 15 micron) and with practically pure air containing a large amount of free atomic radium daughter products. The free products filter with very high efficiency with a high diffusion coefficient, even at rates of 300 cm/sec. (Author abstract modified)

1962

41839 **APTIC NO. 64186**

Bourelly, Therese

DOMESTIC HEATING-GENERATED AIR POLLUTION. DEVICE FOR SMOKE SAMPLING AT THE EMISSION SOURCE. *(La pollution de l atmosphere par les foyers domestiques. Appareil de prelevement des fumees a la sortie des souches). Text in French. Cahiers Centre Sci. Tech. Batiment, no. 55:1-4, April 1962.*

A sampler and simple instrument for the determination of carbon dioxide in flue gases from domestic heating equipment are described. The sampler, placed on top of the chimney, is composed of a rectangular heated probe penetrating into the smoke duct. The flue gas sample is then admitted into a sampling cell accommodating a vertical cyclone and quartz wool filter for the separation of solid and liquid particles. After dehydration, the sample is passed through an absorber composed of eight columns filled with colored sodium-treated, lime for the adsorption and direct determination of the CO2 content. For sampling in tar-containing flue gases, a glass probe is used and no cyclone is employed.

41840 **APTIC NO. 63477**

Fuchs, N. A. and A. G. Sutugin

HIGH-DISPERSED AEROSOLS. *Czechoslovak Academy of Sciences, Aerosols, Phys. Chem. Appl., Proc. Nat. Conf., 1st, Liblice, Czechoslovakia, 1962, p. 8-13. 7 refs. (Oct. 8-13.)*

A method for the generation of reproducible High-disperse aerosols (HDA) with normal properties and a known composition of the disperse phase is described, along with a method for the determination of particle size distribution. Determination of particle size distribution of HDA by the diffusion method involves circular tubes assembled in a diffusion battery. The aerosol particle size magnifier (PSM) is used in which a stream of aerosol is quickly mixed with a stream of hot nitrogen containing the vapor of dibutylphathalate. If certain conditions are observed, the vapor is condensed only on aerosol particles. The mean size of the droplets does not depend on the particle concentration of the aerosol if the latter does not exceed 10,000/cu cm; thus it is possible to measure the relative particle concentration with a nephelometer. No calibration is needed. The reading of the nephelometer and PSM proved to be strictly proportional to the concentration of aerosols within the margin of errors of flowmeters and of the nephelometer. This proportionality is an advantage of the PSM compared with instruments based on adiabatic expansion. Another advantage is the stability of mists formed in the PSM, making optical measurements more reliable. The chemical and physical properties of MDA are discussed.

41841 **APTIC NO. 63497**

Hampl, V. and K. Spurny

ELECTRON MICROSCOPY OF AEROSOL PARTICLES. *(Elektronenmikroskopie von Aerosolteilchen). Text in German. Czechoslovak Academy of Sciences, Aerosols, Phys. Chem. Appl., Proc. Nat. Conf., 1st, Liblice, Czechoslovakia, 1962, p. 301-323. 38 refs. (Oct. 8-13.)*

The possibilities and uses of electron microscopy in aerosol studies are surveyed. Aerosol samples for electron microscopic investigations are separated mainly by sedimentation, centrifugation, impaction, electrostatic or thermal precipitation, by means of isolated microfibers of metal oxides, and by filtration. Stable aerosols of inorganic and even certain organic and liquid aerosols can be directly subjected to electron microscopic investigation without pretreatment of the support surface. Thin, needle-shaped microcrystals of metal oxides also permit the direct investigation of aerosol particles. Membrane filters with aerosol particles are dissolved in ethylacetate to obtain a collodion solution with suspended aerosol particles for electron microscopic studies. Indirect observation of artificially carbon-coated particles permits the study of the surface and of the state of aggregation of aerosol particles apart from particle size and shape studies. The possible reactions occurring between the aerosol particles captured and their support of solvents permit microchemical analyses concerning the nature and composition of such particles.

41842 **APTIC NO. 63487**

Hodkinson, J. R.

THE PHYSICAL BASIS OF DUST MEASUREMENT BY LIGHT SCATTERING. *Czechoslovak Academy of Sciences, Aerosols, Phys. Chem. Appl., Proc. Nat. Conf., 1st, Liblice, Czechoslovakia, 1962, p. 181-194. 26 refs. (Oct. 8-13.)*

Extinction and scattering of light by fine particles, and some light-scattering methods previously applied to industrial dust measurement are described. The principles of light-scattering instruments giving an objective, quantitative measurement of dust concentration are discussed. The extinction and scattering by irregular particles larger than the wavelength of light approximate to the normal formulas of diffraction, refraction, reflection, and absorption are discussed. The polydispersity and irregular particle-shapes of many of the dusts encountered in practice result in a great smoothing and simplification of the phenomena, compared with the systems of exactly spherical particles of exactly equal diameter with which the Mie-theory of light scattering is concerned. Design principles for simple, practical instruments capable of measuring dust concentrations in terms of the total projected area of particles larger than 1/2 to 1 micron in diameter, independently and without knowledge of the particle compositon size-distribution, are given.

41843 **APTIC NO. 63490**

Kubie, G.

ON THE ULTRAMICROSCOPY OF AEROSOLS. *Czechoslovak Academy of Sciences, Aerosols, Phys. Chem. Appl., Proc. Nat. Conf. 1st. Liblice,Czechoslovakia, 1962, p. 207-220. 56 refs. (Oct. 8-13.)*

The basic aspects of the practical application of the ultramicroscopy of aerosol disperse systems are discussed. Ultramicroscopy is the microscopic observation of individual small light scattering objects without the illuminating rays entering the aperture of the observation optics: the small particles appear as luminous objects against a dark background. As used in the study of aerosol problems it can be classed into two basic groups: ascertaining the presence of ultramicroscopic particles in a defined volume of the system under observation, i.e., for measuring the concentration of particles and its changes and observing particle movement under various conditions to study the physical properties of the particles. The design of an instrument for the photographic ultramicroscopy of aerosols using a high-pressure mercury lamp is outlined. The design of a measuring cell for the flow ultramicrosopsy of aerosols is described. Several possibilities of applying ultramicroscopy to the study of physical properties of aerosols are summarized.

41844 **APTIC NO. 63485**

Lodge, J. P., Jr. and E. R. Frank

THE DETECTION AND ESTIMATION OF PARTICULATE FORMALDEHYDE. *Czechoslovak Academy of Sciences, Aerosols, Phys. Chem. Appl., Proc. Nat. Conf., 1st, Liblice, Czechoslovakia, 1962, p. 169-172. 7 refs. (Oct. 8-13.)*

The synergistic effects of aerosols on the toxicity of formaldehyde are investigated using a technique to measure the mass of formaldehyde associated with individual particles. The particles were collected on a chemically-impregnated gel, with the reaction taking place immediately on collection, binding the formaldehyde in place. The method used is based on the demasking of silver ethylenediamine chromate. Simultaneous collections were made in the sensitized plates and on microscope slides coated with silicone oil, enabling the relationship between the mass of formaldehyde and the size of the reaction spot to be estimated. Inherent disadvantages of the technique are discussed. Further work will be necessary to define the precise relationship between reaction spot size and the reacting mass of formaldehyde. The diameter of the spot in microns is equal to approximately 6.2 times the mass of formaldehyde in picograms. The method may lack necessary sensitivity.

41845 **APTIC NO. 63503**

Prokop, M.

SIZE AND MASS MEASUREMENT OF WATER DROPLETS. *(Die Groessen- und Mengenmessungen der Wassertropchen). Text in German. Czechoslovak Academy of Sciences, Aerosols, Phys, Chem. Appl., Proc. Nat. Conf., 1st. Liblice, Czechoslovakia, 1962, p. 565-569. 3 refs. (Oct. 8-13.)*

The physicochemical structure of fog contaminated by particulate emissions in an industrial area in Czechoslovakia was studied. A four-step Casella cascade impactor and microscope with an enlargement over 500 used for the evaluation of the separated particles on the target surfaces which were coated with gelatin solution containing naphthol green were used. The cascade impactor was not suitable for sampling at temperatures under the freezing point, and particles separated on the fourth step could not be differentiated with certainty. The mass maximum comprised fog particles in the size range of 1-3 mm. Dry fog composed of very small particles under the freezing point, a result of combustion equipment-generated emissions, was observed.

41846 **APTIC NO. 63493**

Thuermer, H.

PROPOSALS FOR THE IMPROVEMENT OF THE THERMAL PRECIPITATOR. *(Vorschlaege zur Verbesserung des Thermalpraezipitators). Text in German. Czechoslovak Academy of Sciences, Aerosols, Phys. Chem. Appl., Proc. Nat. Conf., 1st, Liblice, Czechoslovakia, 1962, p. 237-242. (Oct. 8-13.)*

In an attempt to improve the standard thermal precipitator for aerosol particle concentration measurement, the massive heater filament was replaced by coiled filament as used in incandescent lamps to improve the separation by more uniform temperature distribution. No difference in the temperature field of the coiled filament and the massive filament at a close distance from the latter was observed, which is due to the narrow thread. The particle separation was further improved by the use of a set of parallel-connected coiled filaments, and of an electric suction unit providing a uniform flow rate.

41847 **APTIC NO. 63501**

Vrkocova, J. and J. Podzimek

THE CHEMICAL DETECTION OF NH4, NO3, CL, SO4 PARTICLES IN NATURAL INDUSTRIAL AEROSOL. *Czechoslovak Academy of Sciences, Aerosols, Phys. Chem. Appl., Proc. Nat. Conf., 1st, Liblice, Czechoslovakia, 1962, p. 545-552. 13 refs. (Oct. 8-13.)*

This report concerns the chemical detection of aerosol particles important in meteorology using two methods: the method of identifying particles captures on membrane ultra-filters and the method of Liesegang rings (sometimes called the Vittori method in meteorological literature). Cascade impactors and membrane filters were used to detect ammonium and nitrate ions while Liesegang rings, produced on sensitized gelatine films, served to identify chloride and sulfate ions. Methods of collection and treatment of samples are described. A detailed study of diffusion rings and their microstructure confirms that with natural giant chloride nuclei there is a strongly concentrated salt solution. The diffusion patterns of sulfates were irregular and often missing altogether. Only sulfuric acid solutions exhibited Liesegang patterns similar to those found in the atmosphere. For chloride particles the concentrations on the first and second stages were much larger than for sulfates. Giant chloride nuclei have somewhat higher concentrations than sulfates but their number in the range of large nuclei is higher than for chlorides. The chlorides have a wider spectrum in the range of large nuclei with concentrations of several tens of nuclei/l. Laboratory tests were conducted on artificial aerosols and field measurements were taken near a coal sorting plant.

AIR QUALITY MEASUREMENTS

1974

41848 **APTIC NO. 63908**

Asakuno, Kunihiko, Masanao Funashima, Tomio Hirono, Akio Izumikawa, Nobuo Ito, and Toshio Odaira

OXIDANTS AND PARTICULATES (AEROSOLS). *(Okishidanto to ryushijo busshitsu (earozoru) ni tsuite). Text in Japanese. In: Studies on Tokyo Smog. Tokyo Metropolitan Research Inst. for Environmental Protection (Japan), Rept. 3, p. 356-365, March 1974. 3 refs.*

The relationship between aerosols and visibility, particle sizes, and their relationship with other pollutants were investigated. The aerosol concentration was measured by a condensation nuclei counter (CNC) with a minimum detectable particle size of 0.001 micron and particle concentration range of 10-300,000 particles/sq cm in center city and suburban Tokyo. No significant relationship existed between the aerosol count number (CN) and visibility. The visibility at a given aerosol concentration was about 1/4 of the Charlson s value. However, a linear relationship was found between the visibility and aerosol weight concentration (APs) which measured particles larger than 0.5 micron. The APs and CN values vary independently in the area with high primary pollutant concentrations. In the Aoume area with low primary pollutant concentration, the value of CN at given APs is lower, and the relationship between CN and APs is linear. No significant relationship was found between carbon monoxide concentration and CN or APs measured at Aoume, and the high aerosol concentration in such area was attributable to the secondary formation. An inverse correlation was found between the aerosol CN and ozone concentration without the variation in nitric oxide concentration, which indicated that O3 was decomposed by an effect of certain types of aerosol.

41849 **APTIC NO. 63817**

Ban, Yoichiro, Masahide Miyamoto, Makoto Yanami, Yoichi Kudo, and Katsutaka Watanabe

RESULTS OF BAD ODOR SUBSTANCE INVESTIGATION IN NAGASAKI PREFECTURE. PART. 1. *(Nagasaki-ken ni okeru akushu busshitsu chosa seiseki). Text in Japanese. Nagasaki-ken Eisei Kenkyusho-ho (Rep. Nagasaki Prefect. Inst. Pub. Health), p. 21-23, June 1974.*

The malodor in Nagasaki Prefecture was surveyed based on the malodor control standard put into effect on May 31, 1972. The concentrations of ammonia, methyl mercaptan, hydrogen sulfide, methyl sulfide and trimethylamine were measured at 23 measuring points in or at the property line of nine establishements including a dairy farm, pig farm poultry farm, and fish-meal and bone-meal plant between the period of February 20, 1973 and March 15, 1973. The levels of all five pollutants measured at the property line were below the malodor control standard, which was probably attributable to the winter weather. Pollutant data and meteorological factors are given in tabular form.

41850 **APTIC NO. 63830**

Ban, Yoichiro, Masahide Miyamoto, Makoto Yanami, Michio Yamaguchi, Toshiaki Tsutsumi, and Masafumi Murakami

PART II. INVESTIGATION AND RESEARCH. I. RESULTS OF AIR POLLUTION INVESTIGATION IN NAGASAKI PREFECTURE. PART 3. *(II. Chosa kenkyu. I. Nagasaki-ken ni okeru taiki osen chosa seiseki. Dai-3-po). Text in Japanese. Nagasaki-ken Eisei Kenkyusho-ho (Rep. Nagasaki Prefect. Inst. Pub. Health), p. 16-20, June 1974.*

Dust fall was measured by the dust far method and sulfur oxides concentration by the lead dioxide method at 24 points in 5 countries in Nagasaki Prefecture during 1972. For dust fall the pH and amounts of water soluble substance, water insoluble substance, and combustion residue (inorganic substance) were measured. The monthly averagy pH was in the range of 3.8-6.8, while the yearly average range was 4.5-5.0, showing weak acidity. The monthly average dust fall was in the range of 3.47-4.41 ton/l sq m/30 day, and the combustion residue was in the range of 1.61-2.03 ton/k sq m/30 day. The monthly average SOx concentration was in the range of 0.16-0.33 mg SO3/day/100 sq m, and comparison with 1971 data showed a decreasing trend.

41851 **APTIC NO. 65800**

Colacino, M. and A. Lavagnini

PARTICULATE LEAD POLLUTION IN ROME S ATMOSPHERE. *Water, Air, Soil Pollut., 3(2):209-216, June 1974. 20 refs.*

Aerosol lead pollution in Rome was simultaneously measured at four different places and at two different levels (0.5 and 1.5 m) in April, September, and November 1972 and January 1973. The traffic intensity and several meteorological parameters were recorded to determine their influence on aerosol pollution, diffusion, and decay. Lead pollution was practically constant during the year, depending mainly on the local traffic intensity and to a lesser extent on meteorological conditions. Local micrometeorology seemed to be strongly correlated with lead pollution. There was a rough dependence on the wind speed, and the decay time appeared to be less than 1 day. Results were in agreement within an order of magnitude with similar measurements of lead pollution in other urban areas comparable in size to Rome. Lead pollution at 1.5 m was roughly 1/3 less than at 0.5 m level. (Author abstract modified)

41852 **APTIC NO. 65787**

Cuong, Nguyen Ba, Bernard Bonsang, and Gerard Lambert

THE ATMOSPHERIC CONCENTRATION OF SULFUR DIOXIDE AND SULFATE AEROSOLS OVER ANTARCTIC, SUBANTARCTIC AREAS AND OCEANS. *Tellus (Uppsala), 26(1-2):241-249, 1974. 25 refs.*

Measurements of sulfur dioxide and sulfate aerosols were taken over Antarctic and Subantarctic areas and the Mediterranean Sea. Sulfur dioxide atmospheric concentrations of 0.04 to 0.9 micrograms/cu m and sulfate aerosol concentrations of 0.5 to 1.6 micrograms/cu m were measured in these areas. This could be representative of SO2 and SO4 aerosol oceanic background of the earth s surface. Although the air concentration in sulfates and radon over the central Mediterranean Sea is characteristic of Continental inhabited areas, the SO2 concentrations were very low and almost comparable to Subantarctic concentrations. A situation more or less similar is also observed in the Tasmanian Sea. (Author conclusions modified)

41853 **APTIC NO. 64377**

Enders, Karl-Ludwig and Peter Peklo

DEVELOPMENT OF THE DUST SEDIMENTATION IN THE AREA BITTERFELD. *(Entwicklung der Staubsedimentation im Raum Bitterfeld). Text in German. Chem. Tech. (Berlin), 26(7):424-426, July 1974. 6 refs.*

The Halle industrial area with its Bitterfeld center has the highest air pollution in the German Democratic Republic. The sulfur dioxide emission in Bitterfeld in 1971 was 473 tons/sq km/yr the while the average SO2 emission in the GDR was 40 tons SO2/sq km/yr. The sources for the high SO2 emission in Bitterfeld are almost exclusively power plants which in addition emit large quantities of dust (380,000 tons in 1971). In the center of Bitterfeld the highest measured average dust fall is 370 g/sq m/30 days. Throughout the city the long-term emission limit of 15 g dust/sq m is greatly exceeded. For improvement of the situation a reduction of the dust emission from 7 kg dust/ton steam in 1971 to 0.6 kg dust/ton steam in 1980 is planned through the erection of new power plants operated with natural gas and diesel fuel and abandoning the old coal-fired power plants, reconstruction of power plants with improvement of the dust collection facilities, and switching coal-fired power plants to natural gas.

41854 **APTIC NO. 63907**

Funashima, Masanao, Kunihiko Asakuno, Akio Izumikawa, Nobuo Ito, Tomio Hirono, and Toshio Odaira

EXAMINATIONS OF ACID PARTICLES IN SUSPENDED PARTICULATES BY THE METAL MEMBRANE METHOD. *(Kinzoku usumakuho ni yoru fuyu ryushijo busshitsuchu no sansei ryushi no kento). Text in Japanese. In: Studies on Tokyo Smog. Tokyo Metropolitan Research Inst. for Environmental Protection (Japan), Rept. 3, p. 350-355, March 1974. 2 refs.*

The acidic particles in suspended particulates were measured at eight locations by the metal membrane method during the winter and summer of 1973. The sample particulates collected on a thin iron film vapor deposited on glass plate were left standing overnight in a vacuum dessicator, and the corrosion of Fe membrane was examined by taking photomicrographs. Quantitative determination is not feasible at present, however, the results were analyzed according to five criteria. During the winter when sulfur dioxide concentration is higher, the concentration of gaseous pollutants and suspended particulates are higher and so is the acidic particle concentration. On the other hand, even in winter time, the corrosion by acidic particles is slight when the primary pollutant concentrations are low. At the time of smog formation in summer with increased oxidant concentration, the particle sizes are generally smaller, and the corrosion pattern is slightly different with bubbly corrosion around edges. At higher SO2 and oxidant concentration, the amount of acidic particle is increased regardless of the season. The acidic particulate measured in a smoke chamber experiment by the metal membrane method showed that no acidic particles were formed in the first hour of ultraviolet irradiation, and then the acidic particle concentration gradually increased during the period of 2 to 4 hr reaching an equilibrium. In the case of a smoke chamber experiment using automotive exhaust gas at idling, the amount of suspended particulates and acidic particles showed no increase with time, which was probably due to the almost complete absence of SO2.

41855 **APTIC NO. 63706**

Giauque, Robert D., Lilly Y. Goda, and Noel E. Brown

CHARACTERIZATION OF AEROSOLS IN CALIFORNIA BY X-RAY-INDUCED FLUORESCENCE ANALYSIS. *Environ. Sci. Technol., 8(5):436-441, May 1974. 8 refs.*

X-ray-induced X-ray fluorescence analysis was employed to determine elemental concentrations in aerosols collected on impactor films and filter media during Phase I of the Characterization of Aerosols in California study. Elemental diurnal patterns were established for aerosols collected over 2-hr periods. Elemental distributions were correlated with particle size distributions. For data from Fresno, the diurnal patterns for potassium, iron, titanium, and manganese are very similar for the total filter. These four elements are most likely produced by a mechanical process, such as wind-blown soils (large particles). Calcium was also present almost entirely in the large particles and is probably from a mixture of soil and cement particles. Lead and bromine arise from auto emissions and the Pb/Br ratio indicates that they are most likely from an aged aerosol. Several cases of high zinc concentration occurred with the Zn predominantly in the small particle range and the occurrences during late evening or early morning hours. The Zn could be due to incineration of tires or tin cans. Data from Pomona consisted of analysis of three different particle size cuts. The diurnal patterns for Pb and Br were similar for the three size cuts. The diurnal patterns for Fe, Ca, and Ti are also similar to those of Pb and Br, suggesting that these elements originated from the same area. Very large amounts o sulfur were detected which were probably due to a secondary aerosol Los Angeles Harbor Freeway specimens were from the heaviest smog episode during the entire study. Two high Pb peak episodes correspond to the heavy morning and evening traffic and to two of the broad condensation nuclei count maxima. Also the diurnal patterns for Fe and Ca for this stage were very similar. The Fe and Ca may be due to the same source, possibly of sedimentary origin. Aerosols were collected at San Jose on five separate days. On three of these the strontium levels in the aerosols increased dramatically between the hours of 0000 and 0400. Most of the Sr was in particles less than 0.5 micron, indicating it came from an anthropogenic source.

41856 **APTIC NO. 63906**

Hirono, Tomio, Kunihiko Asakuno, Akio Izumikawa, Nobuo Ito, and Masanao Funashima

THE RELATIONSHIP BETWEEN SOLUBLE IONS IN SUSPENDED PARTICULATES AND OXIDANTS. *(Fuyu ryushijo busshitsuchu no suiyosei ion to okishidanto no kankei). Text in Japanese. In: Studies on Tokyo Smog. Tokyo Metropolitan Research Inst. for Environmental Protection (Japan), Rept. 3, p. 335-349, March 1974. 4 refs.*

The concentrations of soluble sulfate and nitrate ions in suspended particulates and dust quantity were measured at five locations during 1972 and 1973. The maximum and minimum concentrations of SO4(--) (microgram/sq m) were 62.67 and 2.63 at Tokogaiken, 63.51 and 2.77 at Rissho Koko, 60.91 and 0.66 at Musashino, 36.97 and 3.63 at Aoume, and 27.67 and 1.13 at Ogochi. The SO4(--) concentration increased with the increase in dust quantity regardless of the season. The SO4(--) concentration and dust quantity decreased with the distance from center city. However, the concentration ratio of SO4(--) in dust increased with the distance as it is 12% in center city and 20% in Aoume and Ogochi. This result suggests the formation of sulfuric acid mist by a secondary reaction besides photochemical reaction, since no significant correlation is found between SO4(--) and oxidant concentration except in one case. The maximum and minimum NO3(-) concentrations (microgram/sq m) were 47.48 and trace at Tokogaiken, 39.97 and trace at Rissho Koko, 28.71 and trace at Musashino, 15.5 and 0.38 at Aoume, and 7.28 and 0.38 at Ogochi. Similarly to the case of SO4(--), the NO3(-) concentration increased with the increase in dust quantity. The NO3(-) concentration ratio was higher in the summer, and increased with the increase in oxidant concentration. The average NO3(-) concentration ratio, 2.4, and intercept of the regression line, 2.7, are in fairly good agreement. The NO3(-) concentration ratio as a primary pollutant is 3%, and the rest is attributable to secondary pollutant formation, indicating that the O3 concentration is the important factor for the formation of nitric acid mist.

41857 **APTIC NO. 64381**

Ito, Masashi, Saburo Fukuoka, Hisao Nakaura, Toshio Odaira, Masayasu Muraoka, and Mitsue Kurose

LOCAL CHARACTERISTIC REPRESENTATION BY OXIDANT CONCENTRATION PATTERNS. *(Okishidanto nodo no chiiki daihyosei ni tsuite). Text in Japanese. In: Studies on Tokyo Smog Tokyo Metropolitan Research Inst. for Environmental Protection (Japan), Rept. 3, p. 505-511, March 1974. 8 refs.*

Using statistical methods for the preparation of representative indexes of sulfur dioxide, hourly averages of oxidant concentration and their boundaries were determined. This data is to be used for designating optimum locations for constructing monitoring stations. Data were analyzed by time succession. The investigations were conducted at 5 locations in the Suginami and Setagaya districts of Tokyo. Oxidant measurements were taken continuously for 1 mo, by potassium iodide method. The sampling locations were all more than 100 m away from artery highways, on the first or second floor of buildings. If the area of investigation is expanded, the boundaries of area represented by certain characteristics are likely to be expanded. Oxidant concentrations are strongly affected by air currents, and it is dangerous to determine the area and distance of representative characteristics by statistical methods alone.

41858 **APTIC NO. 64343**

Kadowaki, Satoshi

DETERMINATION OF SIZE DISTRIBUTION AEROSOLS IN URBAN AIR BY THE ANDERSEN SAMPLER. *(Andasen sanpura ni yoru toshi taikichu no ryushijo busshitsu no ryudo bunpu). Text in Japanese. Bunseki Kagaku (Japan Analyst) (Tokyo), 23(5):490-495, May 1974. 11 refs.*

An Andersen sampler was used to determine the mass frequency distribution of aerosols in urban air. The aerosols were fractionated in eight stages of the Andersen sampler operating at 1 cu ft/min and were collected on stainless steel plates. A membrane filter was placed behind the last stage to collect aerosols which permeated. The sampler was operated continuously from 24 to 27 hours according to the conditions of air pollution and weather. Over a wide range of the size, results obtained were not in agreement with those of either the Junge- type distribution or the logarithmic normal distribution; however, some part of the results agreed approximately with those of the logarithmic normal distribution. The aerosols comprised a mixture of particles belonging to two populations, one with a modal diameter of about 0.4-0.6 micron and the other about 3-5 micron. There was a certain relation between the size distribution of the aerosols in urban air and the concentration of total aerosols. The size distribution curve of the range in stages five, six, and seven, and the back-up filter were proportional to the concentration of the total aerosols. However, the size distribution curve of the range in stages zero, one, two, three, and four were always constant. Therefore, it was estimated that the aerosols in urban air consisted of different typical particles which were formed natural and manmade sources. The particles with a modal diameter of about 3-5 micron were derived from natural phenomena; particles about 0.4-0.6 micron in modal diameter were manmade. The manmade particles caused an increase in aerosol concentration in urban air. The result was compatible with data showing that the mass median diameter values of atmospheric sulfate, nitrate, and ammonium particles were about 0.3-0.5 micron, and iron, magnesium, and phosphate particles were about 3-5 micron.

41859 **APTIC NO. 64374**

Kirsch, H. and K. Schwinkowski

IMMISSION MEASUREMENTS OF AIRBORNE DUST, LEAD AND HYDROGEN CHLORIDE IN THE NEIGHBORHOOD OF A GALVANIZING PLANT AND POSSIBILITIES OF LIMITING THE POLLUTANTS. *(Immssionsmessung von Schwebstaub, Blei und Chlorwasserstoff im Einwirkungsbereich einer Feuerverzinkerei und Moeglichkeiten der Begrenzung der Schadstoffe). Text in German. Z. Ges. Hyg. ihre Grenzgebiete (Berlin), 20(7):413-415, 1974. 12 refs.*

Emission measurements were made in an area affected by a hot-dip galvanizing plant of airborne dust, lead, and hydrogen chloride. The mean value of 32 measured values of dust was 0.18 mg/cu m. For lead, the values considerably exceeded the limiting value. The mean value was 0.0031 mg/cu m. The highest values were obtained for hydrogen chloride. The mean value of 36 measurements was 1.53 mg/cu m. All measurements were made at distances from 40 to 100 m. Lead and HCl were determined photometrically, dust by membrane filter and weighing. Control strategies are outlined.

41860 **APTIC NO. 65793**

Lodge, James P., Jr., P. A. Machado, J. B. Pate, D. C. Sheesley, and A. F. Wartburg

ATMOSPHERIC TRACE CHEMISTRY IN THE AMERICAN HUMID TROPICS. *Tellus (Uppsala), 26(1-2):250-253, 1974. 15 refs.*

Atmospheric trace chemistry in the American humid tropics and reasons for variations are discussed. Data are tabulated on concentrations of ammonia, nitric oxide, nitrogen dioxide, and sulfur dioxide. Ammonia is the most variable of the species measured. Measurements at Fort Sherman, Panama were among the highest obtained. Apparently this is not a phenomenon of the Caribbean, of itself, but of the foreshore. Sulfur dioxide tended to be higher in Panama than in Amazonia. With a few exceptions, there appeared to be a general downward trend with distance from the ocean. Other things equal, SO_2 anticorrelates with humidity; as does appearance of sulfuric acid. Both nitrogen oxides are lower in Amazonia than in Panama, higher in the temperate mid-latitudes. The mean tropical values tabulated are assumed as representative of the tropics worldwide, pending measurement in the eastern hemisphere tropics.

41861 APTIC NO. 63819

Murakami, Taizo

AIR POLLUTION IN OSAKA PREFECTURE AROUND THE IMOMA MOUNTAIN RANGE. PART 1. *(Ikomayama- kei o chushin to shita Osaka fuka no taiki osen. Dai-1-po). Text in Japanese. Kinki Daigaku Kogai Kenkyusho Kenkyu Hokoku (Kinki Univ. Pollut. Res. Inst. Rep.), no. 1:113-138, June 1974. 1 ref.*

The major pollutant sources in Osaka prefecture are 18 industries located in the Seibu and Sakai littoral areas. The total fuel consumption in Osaka prefecture for 1972 was 15,100,000 kl in terms of heavy oil, and more than 1/3 was consumed by these 18 industries. Enormous amounts of suspended and settling particulates and toxic gases emitted from 100-200 m high smoke stacks are carried to Ikoma mountain regions located about 20 km from the littoral area in 1-2 hr by the sea wind of 3-5 m/sec velocity. The air pollution status in Ikoma mountain regions was surveyed. The suspended particulate, sulfur dioxide, nitrogen oxides, and carbon monoxide concentrations were measured at various periods during 1970, 1971 and 1972 at 25 measuring points along with the meteorological factors. The data obtained are analyzed in relation to the meteorological and topographical factors. It is dangerous to draw definite conclusions from the data obtained, however, the complexity of air pollution and increasingly aggravated air pollution problems are quite evident.

41862 APTIC NO. 63910

Nakano, Kinji, Masataka Sofuku, Hisaji Yokota, Tokiko Tsukada, Akio Izumikawa, and Saburo Tsukada

A PROGRESS REPORT ON THE ANALYSIS OF SPECIAL INVESTIGATION OF SCHOOLS WITH PHOTOCHEMICAL SMOG VICTIMS AND THE ATMOSPHERIC CYANIDES. *(Higaiko tokubetsu chosa ni okeru bunseki kekka, oyobi taikichu shian chosa kekka no chukan hokoku). Text in Japanese. In: Studies on Tokyo Smog. Tokyo Metropolitan Research Inst. for Environmental Protection (Japan), Rept. 3, p. 383-389, March 1974. 10 refs.*

In search for the pollutant involved in photochemical smog afflictions, the air samples collected at 21 schools when such affliction occurred from April through September 1973 were analyzed. The concentrations measured were non-methane hydrocarbons, 1.1-2.2 ppm; carbon monoxide, 0.7-5.3 ppm (environmental standard 20 ppm/8 hrs); nitrogen dioxide, 0.019-0.19 ppm (environmental standard 0.02 ppm/24 hrs); chlorine ion, below detection limit of 3 pphm; cyanide, below detection limit of 0.005 ppm (7 samples out of 9) and 0.008 and 0.009 ppm (1 sample each); acrolein, below 5 ppb (8 out of 12 samples) and 7-10 ppb (4 samples); formaldehyde, 0.011-0.064 ppm; and the presence of peroxyacetyl nitrate detected in all except one case. In all cases, the pollutant concentrations were below abnormal levels, however, the presence of PAN confirmed the photochemical smog formation. Ever since the detection of CN compound in Ibaraki photochemical smog incidents, the CN compound is suspected to be the cause of smog afflictions. At 6 locations, the CN concentration was measured during the periods of July 16-26 and October 20-30, 1973. Both the average value and maximum value were higher in the fall. The concentration at automotive exhaust emission measuring stations was higher than that in the industrial area, and a definite correlation was found between the high CN concentration and pollutants concentration in automotive exhaust gas. Therefore, the atmospheric CN compounds presumably originate in automotive exhaust gas.

41863 APTIC NO. 63987

Neiser, Jan and Vaclav Masek

THE QUALITY OF TAR SUBSTANCES IN THE AIR OF PITCH PROCESSING PLANTS AND IN THEIR VICINITY. *(Zur Qualitaet der Teersubstanzen in der Luft eines pechverarbeitenden Betriebes und seiner Umgebung). Text in German. Bitumen, Teere, Asphalte, Peche, 25(6):242-245, 1974. 6 refs.*

Tar and dust concentrations in the air of a pitch processing plant and at increasing distances from the emission source in the direction of the prevailing winds were determined by means of a Selas-Flotronics silver membrane filter. For better identification of the various components in the separated substances scanning electron microscope pictures were taken, the grain size distribution of the fly dusts were determined, the 3,4-benzpyrene and total sulfur concentrations were analyzed, the relative molecular mass of the tar substances was determined, and spectral analyses were taken. Samples for the analyses were taken at 5, 300, 700, 1100 and 2000 m from the plant. The sulfur content declined from 0.65% by weight at 5 m to 0.35% at 2000 m. The benzo-3,4-pyrene decreased from 3120 micrograms five m from the source to 72 micrograms/g tar substance 2000 m from the plant. The tar substance molecules have the shape of a polydisperse cluster. The measured spectra belong primarily to aromatic compounds with changing concentration of some types of keto and hydroxyl compounds. With increasing distance from the emission source mono- and bi-aromatics gradually disappeared.

41864 APTIC NO. 63884

Odaira, Toshio

CORRELATION BETWEEN PRIMARY POLLUTANTS AND OXIDANTS CONCENTRATION OF LOS ANGELES AND TOKYO. *(Rosanzerusu to Tokyo ni okeru ichiji osenshitsu to okishidanto no kankei). Text in Japanese. In: Studies on Tokyo Smog. Tokyo Metropolitan Research Inst. for Environmental Protection (Japan), Rept. 3, p. 40-65, March 1974. 13 refs.*

Measurements of nitric oxide, nitrogen dioxide, oxidants, and carbon monoxide made in Los Angeles in July 1972 were compared with the measurements taken in Tokyo. The methods of measurement for oxidants for both cities were 10% potassium iodide solution spectrophotometry, (with the chromium oxide scrubber for Tokyo). Both offices used Saltzman reagent spectrophotometry for NOx and non-dispersive infrared spectrophotometry for CO. The oxidant and CO measurements in Tokyo were both about 1/3 of the L. A. measurements, NOx was about 1/7 of the L. A. measurements, and the non-methane hydrocarbons were 1/2 to 1/3 lower than the L. A. measurements. The L. A. concentration variation patterns showed peaks for NO and CO at 6-8 am for NO_2 at 8-10 am, and for oxidant at 11 to 2 pm. In Tokyo, the only consistent peak was for oxidants, between 11 am and 4 pm. The NO and CO measurements in both cities were lower on weekends and holidays than on weekdays, and oxidant measurements were higher on holidays. The rate of weekend decrease for NOx and CO measurements was greater for L. A. than Tokyo. The L. A. data showed a significant correlation (with a 5% discard rate) of oxidant concentration at noon with NO_2 and CO measurements at 9, 10, and 11 am.

41865 APTIC NO. 66083

Okita, Toshiichi, Kazuko Kaneda, Takaaki Yanaka, and Ryuichi Sugai

DETERMINATION OF GASEOUS AND PARTICULATE CHLORIDE AND FLUORIDE IN THE ATMOSPHERE. *Atmos. Environ., 8(9):927-936, Sept. 1974. 22 refs.*

The measurement of gaseous and particulate chloride and fluoride in the atmosphere was accomplished using a combination of a Millipore filter and a sodium carbonate impregnated filter. The sampling flow rate was about 20 l/min, and the Millipore pre-filter was heated during the sampling. Hydrogen chloride and hydrogen fluoride were collected by a filter impregnated with 1% sodium carbonate and particulate and gaseous components of chlorides and fluorides were separated by aerosol filters in laboratory tests. The impregnated filter was also tested in a field study of gaseous and particulate chlorides and fluorides in Japan and Manila. The gaseous chloride concentration was high at the coast and on mountains, but the sources of the gaseous chloride concentration was obscure. The significance of sea salts, volcanoes, and man-made sources varied from place to place. Samplings of fluoride revealed that near and in an aluminum refining plant, the percentage of particulate component was higher than that of the gaseous component. (Author abstract modified)

41866 **APTIC NO. 64327**

Prusakov, V. M.

ASSESSMENT OF THE RESPECTIVE CONTRIBUTIONS OF POLLUTANT EMISSION SOURCES TO AIR POLLUTION IN INHABITED AREAS. *(K otsenke otdel nykh istochnikov vrednykh vybrosov v zagryaznenii vozdushnogo basseyna naselennykh mest). Text in Russian. Gigiena i Sanit., no. 5:86-90, 1974. 4 refs.*

The contributions by different pollutant emission sources in the maximum and average pollutant levels were approximately determined by means of known mathematical methods for the determination of the maximum one-time and daily average concentrations. This method was applied to the determination of the respective shares of different emission sources to the peak and daily average concentrations at different sampling points in an industrial area with several sulfur dioxide emission sources. The contributions by the individual sources to the peak and daily average concentrations in different points are expressed as fractions of the maximum allowable concentration.

41867 **APTIC NO. 63470**

Ripperton, L. A., J. J. B. Worth, C. E. Decker, and D. R. Johnston

HIGH OZONE CONCENTRATIONS IN NON-URBAN AIR. *Research Triangle Inst., Research Triangle Park, N. C., Environmental Protection Agency Contract 68-02-1077, 34p., 1974. 9 refs. (Presented at the American Chemical Society Meeting, March 1974.)*

Non-urban ozone concentrations were measured at areas at or near Lewisburg, W. Va., McHenry Md., Kane, Pa., and Coshocton, Ohio in 1973. The O3 concentrations frequently exceeded the National Ambient Air Quality Standard for photochemical oxidants (160 micrograms/cu m, minimum 1 hr concentration not to be exceeded more than once per year) during the period June 26-Sept. 30, 1973. At Lewisburg, O3 concentrations exceeded the standard during 15% of 1663 hr. At Mchenry, the standard was exceeded during 37% of 1652, at Kane, 30% of 2131 hr; and the Coshocton, 20% of 1785 hr. The high O3 values found in non-urban areas are produced, at least in part, by long range transport of pollution. (Author abstract modified)

41868 **APTIC NO. 63647**

Shum, Y. S. and W. D. Loveland

ATMOSPHERIC TRACE ELEMENT CONCENTRATIONS ASSOCIATED WITH AGRICULTURAL FIELD BURNING IN THE WILLAMETTE VALLEY OF OREGON. *Atmos. Environ., 8(6):645-655, June 1974. 10 refs.*

Neutron activation analysis was used to measure trace element concentrations in gross air particulate samples as well as size fractionated samples associated with agricultural field burning in rural western Oregon. The atmospheric trace element abundances associated with field burning appeared due to the trace element content of the stubble being burned and did not represent a significant health hazard. The trace elements were concentrated in the larger sized particles with diameters greater than 11 micron. Oregon's rural air trace element content was very low and indicative of the nature of the continental background contribution to urban atmospheres. (Author abstract modified)

41869 **APTIC NO. 65805**

Takahashi, Masaaki, Noriyoshi Ito, Hiroshi Hirobe, Susumu Tsukada, and Yumiko Kobayashi

HYDROCARBONS IN THE AIR ON DAYS OF PHOTOCHEMICAL SMOGS. *(Kokagaku sumoggu hasseibi ni okeru taikichu no tanka suiso). Text in Japanese. Mie-ken Kogai Senta Nenpo (Mie Prefect. Pub. Nuisance Center), no. 2: 97-101, March 1974. 4 refs.*

As a step toward the analysis of photochemical smogs in Yokkaichi, hydrocarbons (aliphatic HCs from C3 to C7 and aromatic HCs) in the air were analyzed on days of photochemical smogs in summer of 1973. On these days, the maximum measurements of oxidants all exceeded 100 ppb and in all cases, smog warnings or alerts were issued. The measurements at five locations showed no special concentration patterns for HC and measurements ranged between 50 and 100 ppb, but oxidant measurements reached a maximum around 2 pm. The ratio of aromatic HCs to the total HCs seemed to decline between 11 am and 4 pm, though not too clearly. Between 9 am and 4 pm, the ratio of benzene, n-hexane, and n-pentane seemed to be slightly higher than at night. The data was too limited to yield a conclusive picture, but suggested pollution of a greater area outside those five locations. Compared to the investigation in Tokyo, the ratio of aromatic HCs seemed to be smaller in Yokkaichi.

41870 **APTIC NO. 65887**

Volchok, H. L., L. Toonkel, and M. Schonberg

RADIONUCLIDES AND LEAD IN SURFACE AIR. *In: Health and Safety Laboratory. Fallout Program. Quarterly Summary Report. Appendix. Atomic Energy Commission, New York, p. B1-B10, B117-B124, July 1, 1974. 7 refs.*

NTIS: HASL-284

The spatial and temporal distribution of nuclear weapons debris and lead in the surface air were studied. Gamma activity, manganese-54, iron-55, strontium-90, cadmium-109, cesium-144, and other nuclides, and stable lead were measured in the surface air. The surface air sampling stations and results of stable lead concentration measurements are listed.

41871 **APTIC NO. 63645**

Willeke, K., K. T. Whitby, W. E. Clark, and V. A. Marple

SIZE DISTRIBUTIONS OF DENVER AEROSOLS - A COMPARISON OF TWO SITES. *Atmos. Environ., 8(6):609-633, June 1974. 8 refs.*

A Minnesota Aerosol Analyzing System for field measurements of atmospheric aerosol size distributions was used to compare the urban Denver environment with the environment of a nonurban location several kilometers downwind of Denver. The ratio of submicron (fine) particles to the total of fine and coarse particles varied from 1 to 73% on a volume (or mass) basis depending on the type of emission source close to the measurement site. Surface distribution plots revealed two distinct modes in the fine particulate range below particle diameters of 1 micron. A Transient Nuclei Range Mode at about 0.01 micron was particularly prominent when fresh aerosols were emitted from automobiles on a freeway, and an Accumulation Range Mode at about 0.1 micron dominated during a pollution episode when measurements were made several km downwind of the industrial complex. Increase in particle surface in the visible range was directly related to visibility degradation. The steepness of the negative slope of the size distribution curve in the visible range may partially explain the color of Denver s brown cloud. High humidity appeared to accelerate the coagulation of automobile-generated particles. (Author abstract modified)

41872 **APTIC NO. 63721**

Japan Assoc. for Clean Air, and Shibaura Inst. for Engineering

INVESTIGATION REPORT ON SUSPENDED PARTICULATE MEASUREMENTS ON TOLL ROADS. *(Yuryo doro ni okeru fuyu funjin sokutei chosa hokoku). Text in Japanese. Kuki Seijo (Clean Air-J. Japan Air Cleaning Assoc., Tokyo), 12(1):1-18, April 1974.*

The behavior of suspended particulate concentration at roadside and the effect of traffic volume and meteorological conditions was investigated by measuring continuously the suspended particulate concentration at two locations from September 1972 to February 1973. A dust meter and filter paper dust meter were used. The traffic volume, wind direction, and wind velocity were measured simultaneously. No specific relationship was found between the suspended particulate concentration and traffic volume. Using the high volume air sampler and low volume air sampler as well as the above-mentioned two instruments, the correlations between instruments were studied. To determine the amount of dust raised by motor vehicles, the suspended particulate concentration, ventilation volume, traffic volume, wind direction, and wind velocity were measured in a tunnel. An equation for determining the amount of dust raised by a moving motor vehicle was theoretically derived. The amount of dust raised by motor vehicles are 0.260 mg/m for compact cars and 0.722 mg/m for full size cars. The diffusion of suspended particulates from super highways was investigated by measuring the suspended particulate concentration, traffic volume, wind direction, and wind velocity. The diffusion of the suspended particulate is governed by many factors and the accurate measurement of the diffusion distribution seems to be an impossible task. An equation for estimating the suspended particulate concentration in the mixed diffusion layer is theoretically derived.

41873 **APTIC NO. 63937**

Tokyo Metropolitan Research Inst. for Environmental Protection (Japan)

MEASUREMENT OF PEROXYACETYL NITRATE. *(PAN sokutei kekka). Text in Japanese. In: Studies on Tokyo Smog. Tokyo Metropolitan Inst. for Environmental Protection (Japan), Rept. 3, p. 786-816, March 1974.*

Measurements of peroxyacetyl nitrate taken at the Tokyo Metropolitan Research Institute for Environmental Protection between June 13 and July 13, 1973, those taken at Tokyo Rissho High School between July 1 and August 29, 1972, and those taken at the Aome Youth Center Between June 13 and July 6, 1973 are presented in their entirety. The measurements were taken 3 times/hr for 24 hr/day.

1973

41874 **APTIC NO. 64055**

Chow, Tsaihwa J.

OUR DAILY LEAD. *Chem. Brit., vol. 9:258-263, 1973. 80 refs. (Presented at the International Congress on Chemical Engineering in the Service of Mankind, Paris, France, Sept. 1972.)*

Figures on the distribution of lead in the earth, sea, air, flora, and fauna around the world are presented. Atmospheric Pb concentrations in various locations are tabulated and range from 0.0002 micrograms/cu m for Novaya Zemlya, USSR to 71 micrograms/cu m recorded during a peak traffic period along a Los Angeles freeway. Rain water contains significant Pb levels as a result of airborne Pb being washed out in the precipitation process. An average of 36 micrograms/l of Pb was reported for a U. S. nationwide sampling network. Soil samples are tabulated from the continents and range from an average of about 10 ppm in Antarctic soils, which is the natural occurrence, to 100-3000 ppm in urban areas in proportion to the proximity to traffic. Changes in Pb content in vegetation as in the case of mosses can be used as an indicator or regional airborne Pb pollution. The largest source of Pb pollution is the burning of Pb alkyl additives in automobile fuels. The Pb aerosol emissions in the U. S. in 1968 were 184,614 tons, of which 181,000 tons were attributed to leaded gasoline combustion. Government policies to control Pb pollution are described including proposed regulations from the Environmental Protection Agency.

41875 **APTIC NO. 64016**

Donagi, A. E., J. Mamane, and T. Anavi

AIR POLLUTION TRENDS IN TEL AVIV, ISRAEL. *Society of Engineering Science, Pollut. Eng. Sci Solutions, Proc. Int. Meet. Soc. Eng. Sci., 1st, Tel Aviv, Israel, 1972, p. 664-670, 1973. (June 12-17.)*

An air quality monitoring system began operating in Tel Aviv in the summer of 1969 to measure sulfur dioxide, nitrogen oxides, carbon monoxide, hydrocarbons, soiling, and wind direction and speed. The sampling sites and system and trends for 1969-1970 are discussed. Highest SO2 concentrations were at noon in the summer and spring and between 8 and 10 am during the winter, showing a relationship to external temperature. No correlation was found between seasonal fuel consumption and SO2 levels. Days with high precipitation and low ambient temperatures had low SO2 concentrations. High concentrations were also correlated to anticyclonic conditions. Saturday averages were about 10% lower than the average SO2 values for the other days of the week due to decreased industrial activities. Highest CO and soiling index averages were in winter. Air pollution levels in Tel Aviv were relatively low compared to the U. S. except for CO2.

41876 **APTIC NO. 63861**

Ikebe, Yukimasa, Michikuni Shimo, and Kenji Ishida

MEASUREMENT OF SUBMICRON PARTICLE SIZE DISTRIBUTION BY THE STATIC METHOD, II RESULTS OF MEASUREMENT PART I. *(Static hoshiki ni yoru sabumikuron ryushi no ryukei bunpu sokutei (II), sokutei kekka sono I). Text in Japanese. Taiki Denki Kenkyu (Proc. Soc. Atmos. Electr. Jap.), no. 8:107, 110, Feb. 1973.*

The principles, analytical methods, and application of the static method of submicron particle size distribution were examined. Using this method, measurements of particle size distribution were examined in natural environments on the campus of Nagoya University, at the Matsushiro Observation Station, and the Tadeshina Highland Weather Observation Station, both in Nagano Prefecture. The peaks of distribution on the NU campus were in the large range between 0.004 and 0.07 micron. The particle sizes were generally large in fog and haze; when the aerosol count was higher, smaller particles were more often found and two peaks were found in the distribution pattern. From the measurements at two observation stations, the background aeroso measurement of Nagano prefecture was less than 4000/cu cm, and the peaks were about 0.014-0.04 micron. When the aerosol count was high, without exception, layers of small particle aerosols were found piled up on the background and two peaks were found. These small particle aerosols were combustion gas nuclei.

41877 **APTIC NO. 63824**

Ishino, Toru and Hiroyuki Yoneda

DUSTS AND TOXIC GASES CREATED IN THE PROCESS OF CASTING. *(Chuzo kogyo no seizo kotei de hassei suru funjin yugai gasu ni tsuite). Text in Japanese. Kinki Daigaku Kogai Kenkyusho, Kenkyu Hokoku (Kinki Univ. Pollut. Res. Inst. Rep.), no. 1:69-99, June 1973. 6 refs.*

The air pollution status in a foundry was investigated by measuring the concentration, amount, chemical composition and size distribution of particulate matter and the concentration of toxic gases (carbon monoxide, sulfur oxides and nitrogen oxides) emitted from cupola and low-frequency induction electric furnace. The concentration of particulates and the composition and concentration of toxic gases generated during the molding, pouring and unmolding processes were also measured. The data on the amount of particulates collected by a dust collector, concentration of scattered particulates and collection rate were obtained. The relationship between the above-mentioned measured values and various technical factors (type of heat source for melting, type of material used for molds, type of raw material and others), and air pollution control status are discussed. The particulate concentration in cupola exhaust gas is about 6-7 g/N sq m, and the size distribution is mostly in the range of 60-100 micron. However, a fairly large amount of micro-particles of 3-40 micron size is also emitted. The dust collection rate is 33% by the dry [illegible] method and 70% by the wet cap method. Therefore, it is quite difficult to meet the new environmental standard of [illegible]-0.4 g/N sq m with the present control measures.

41878 **APTIC NO. 63837**

Itakura, Atsushi and Takatoshi Tajima

A SURVEY OF ENVIRONMENTAL POLLUTION BY MANGANESE DUST OUT OF A FERRO-MANGANESE PRODUCING FACTORY IN KANAZAWA. *(Kanazawa shinai fero mangan seizo kojo no mangan funjin ni yoru kankyo osen chosa seiseki). Text in Japanese. Ishikawa-ken Eisei Kenkyusho Nenpo (Annu. Rep. Ishikawa Prefect. Inst. Public Health), no. 9:40-50, March 1973. 8 refs.*

The manganese pollution in the surrounding area of a ferromanganese factory was surveyed. The dust and Mn concentrations in the smoke stack were 280-1038 micrograms/cu m and 23-201 micrograms/cu m, and the Mn content in the dust was as high as 7.6-25.1%. The Mn concentration in settling particulates was 123-321 kg/sq km/mo within 0.5 km radius and 1.1-11.1 kg/sq km/mo in the unpolluted area in Kanazawa. The value of the former is almost 30 times of that of the latter, showing an extremely high degree of Mn pollution. The suspended particulate and Mn concentrations in the immediate area of the pollutant source reached a peak at 300 m, and average suspended particulate and Mn concentrations at 300 m were 160 microgram/cu m and 6.7 microgram/cu m, a frighteningly high Mn concentration. The Mn concentration in the soil was highest within a 100 m radius and decreased gradually with distance. In the area more than 500 m away from the pollutant source, the Mn concentration was drastically reduced. The average Mn concentrations in Japan cedar leaves were 505 ppm within 300 m radius, 132 ppm at 300-600 m, 75 ppm at 600-900 m and 39 ppm in the unpolluted area at 3 km, indicating that the plant leaves can be an environmental pollution indicator. After the installation of a dust collector for stack exhaust gas, the dust and Mn concentrations in the smoke stack were reduced to about 1/100, and the atmospheric Mn concentration was also reduced to about 1/3.

41879 **APTIC NO. 64379**

Kato, Toyomasa, Morihiko Hayakawa, and Yozi Naruse

FUNDAMENTAL STUDIES ON THE PHOTOCHEMICAL SMOG (I). THE RELATION BETWEEN OXIDANT AND SOME OTHER AIR POLLUTANTS. *(Kokagaku sumoggu ni kansuru kisoteki kenkyu (daiippo) okishidanto to ta no osen busshitsu to no kankei). Text in Japanese. Nagoya-shi Kogai Kenkyusho-ho (Rep. Environ. Pollut. Res. Inst., City Nagoya), no. 2:47-50, 1973. 4 refs.*

To examine the factors in oxidant formation, measurements of dusts, nitrate, sulfate, nitrogen dioxide, an/ sulfur dioxide were taken and the correlations between oxidants and these pollutants were examined. The measurements were taken on the roof of the Nagoya Municipal Environmental Pollution Research Inst. in August and September, 1972. Regression equations using each pollutant concentration as a variable were obtained. A high correlation of 0.70 was noted between nitrate and oxidant, and of 0.66 between dusts and oxidant. When oxidant concentration was more than 6 pphm, nitrate was more than 7 microgram/cu m, dusts, more than 100 microgram/cu m, sulfate more than 6 microgram/cu m, SO2 more than 2.5 pphm, and NO2 more than 1.7 pphm. In the residential areas, correlation was noted between nitric oxide concentration from 5-9 am and oxidant concentration from 9-11 am. Also a high correlation was noted between NO2 measurement at 9 am and oxidant concentration from 9-11 am. It has been reported that in Los Angeles, the level of nitrate rose with photochemical smog. In this investigation, the level of sulfate was much higher than that of nitrate at the time of high oxidant concentration.

41880 **APTIC NO. 64098**

Kinosian, John R.

OXIDANT TRENDS IN THE SOUTH COAST AIR BASIN 1963-1972. *California Air Resources Board, Sacramento, Calif., Division of Technical Services, 32p., April 1, 1973. 7 refs.*

Oxidant trends and distribution in the South Coast air basin for 1963-1972 are described. Data presented for 15 air monitoring stations show that a decline began as early as 1964 in the south and west portions of the basin. Moving toward the northeast portion of the basin, the year of initial decline progressed to 1970. Three year moving averages are used to show: the trends from 1963 through 1972 and the distribution of oxidant concentration and the decreases of the concentration from the time of the highest 3 yr period to 1970-1972. The lowest concentrations and the greatest declines were in the south and west portion of the basin. The 3 yr average of the daily maximum 1 hr concentration during the smog months of 1970-1972 at the station in Los Angeles, for example, was 11.5 pphm, a decrease of 27% from the highest 3 yr average, 15.8 pphm, which occurred in the period 1965-1967. The highest concentrations and lowest declines were in the northeastern portion of the air basin. At Riverside the 3 yr average during the smog months of 1970-1972 was 23.6 pphm and the decline from the highest 3 yr period, 1969-1971, to 1970-1972 was less than 5%. (Author summary modified)

41881 **APTIC NO. 64350**

Kuriyama, Masayuki

INVESTIGATION OF AIR POLLUTION IN THE VICINITY OF MUKOGAWA COLLEGE (REPORT II). *(Mukogawa Gakuin shuhen ni okeru taiki osen chosa, dainiho). Text in Japanese. Mukogawa Joshi Daigaku Kiyo (Bull. Mukogawa Womens Univ.), no. 20-21:25-31, 1972-1973. 4 refs.*

The state of sulfur oxides and dust pollution in the vicinity of Mukogawa College in Nishinomiya is presented. The college was once known for its clean air and scenic environment. The pollution and meteorological data of Nishinomiya and the adjacent Amagasaki were obtained from the two municipal governments for comparisons. In this area, the land breeze dominates in morning and evening, and the sea breeze dominates during the day throughout the year. The school received pollutants equally from Nishinomiya and Amagasaki. The sulfur trioxide level measured by the lead dioxide method shows higher levels during winter months, with an extremely high average of 1.89 mg/100 sq cm/day in December. The lowest average is 0.71 mg in October. The high winter figures agree with the high SOx level of some parts of Amagasaki which is in northeast of the college. This is the effect of the northeast wind in winter, but an inversion layer forms easily in winter in this area and pollutant dispersion is poor. In both cities, SOx decreased drastically in 1971, but the college area did not show a notable decrease until 1972. The level of settling particles is higher in summer in both cities, but the dust level in the college area is low. There are no dust emission sources in the immediate vicinity of the college. These results show the effects of pollution from the both adjacent cities on the college campus; but the college is usually free of heavy pollutants during the day because of the relatively clean sea breeze. However, when pollution increases, the pollutants carried into Osaka Bay during the night by the land breeze may return with the sea breeze during the day, causing a photochemical smog.

41882 **APTIC NO. 64022**

Miller, D. F., W. E. Schwartz, P. W. Jones, D. W. Joseph, C. W. Spicer, C. J. Riggle, and A. Levy

HAZE FORMATION: ITS NATURE AND ORIGIN. 1973 (SECOND YEAR REPORT). *Battelle Memorial Inst., Columbus, Ohio, Columbus, Labs., Environmental Protection Agency Contract 68-02-0276, Proj. 21AKB-03, Program Element 1A1008, Rept. EPA-650/3-74-002, 178p., June 1973. 9 refs.*

Aerosol analyses, continuous monitoring of meteorological conditions and gas phase composition of the air for carbon monoxide, nitrogen dioxide, ozone, methane, ethylene, acetylene, and total hydrocarbons, and measurements of light scattering were conducted at downtown Columbus, Ohio, New York City, and in Pomona, California to investigate the nature and origin of haze formation. Some of the observations suggest: small contributions of automotive emissions to the hydrocarbon burden in New York City, moderate photochemical aerosol formation in New York, a high positive correlation between light scattering and aerosol mass concentration for particles less than 2 micron, significantly different chemical composition for aerosols above and below 2 micron, predominance of metallic compounds is greater than 2 micron aerosols, and the predominance of organic compounds and sulfates in less than 2 micron aerosols in Columbus and New York.

41883 **APTIC NO. 65943**

Reay, J. S. S.

MONITORING OF THE ENVIRONMENT. *Inst. of Fuel, London (England), Fuel Environ. Proc. Conf., Eastbourne, England, 1973, p. 105-110. (Nov. 26-29, Paper 7.)*

Global and regional air pollutant monitoring activities by the World Meteorological Organization are reviewed along with national monitoring programs in Great Britain. Seven WMO baseline stations monitor carbon dioxide, particulate matter via turbidity, and the chemical composition of precipitation, including sulfates, chlorides, ammonium ion, nitrates, calcium, magnesium, potassium, pH, and conductivity. Regional and national monitoring in Great Britain includes measuring the concentration of airborne radioactivity and its deposition in rain and the drift of pollutants such as sulfur dioxide and its transformation products between countries of northwestern Europe. National monitoring in Great Britain is also performed for the following specific combustion-produced pollutants: carbon dioxide, carbon monoxide, water, nitrogen oxides, hydrocarbon residues and particulates from unburned or partially burned fuels, sulfur oxides, lead, and such trace elements as germanium, selenium, vanadium, and mercury. Data are given for regional distributions of smoke concentrations and domestic coal consumption and sulfur dioxide concentrations in Great Britain. The monitoring of grit and dust and a five towns surveys of automobile pollutants are also discussed.

41884 **APTIC NO. 63708**

Saito, Koichi and Tatsuya Saijo

ENVIRONMENTAL POLLUTION BY AUTOMOBILE EXHAUST GASES--CONDITIONS AT INTERSECTIONS AND CONGESTED TRAFFIC AREAS. *(Jidosha haishutsu gasu ni yoru kankyo osen ni tsuite--kosaten oyobi kotsu kamitsu chiiki no jittai). Text in Japanese. In: Ibaraki- ken Kogai Gijutsu Senta Kenkyu Hokoku. p. 68-80, July 1973. 4 refs.*

At intersections and congested traffic areas, the levels of carbon monoxide, nitrogen oxides, sulfur dioxide, oxidants, hydrocarbons, and lead were measured with a 24-hour continuous sampler using automatic recorders (except for lead which was determined by the atomic absorption method). Meteorological factors, wind velocity, wind direction, humidity, and traffic volumes were also measured for the purpose of comparative analysis. Hourly values of CO, nitric oxide, and Pb concentrations varied with the traffic volume. Other pollutants showed no significant correlations with traffic volume. However, significant correlations were found between pollutants. The 24-hour average of CO gave a fairly low value of 1.1-5.6 ppm, while the NO level showed a considerably high value of 0.031-0.306 ppm. Lead concentrations were 3.89 micrograms/cu m in 1971 and 1.68 micrograms/cu m in 1972, which were lower than the 5 micrograms/cu m environmental standard. The higher NO concentration at night, particularly at 4 am, and the increase in oxidant concentrations observed in some areas were very similar to conditions of nighttime smog in Tokyo. Hourly variations in pollutant concentration at intersections at the time of photochemical smog formation showed a typical smog formation pattern.

41885 **APTIC NO. 63471**

Stephens, Edgar R.

HYDROCARBONS IN POLLUTED AIR (SUMMARY REPORT). *Univ. of California, Riverside, Statewide Air Pollution Research Center, Coordinating Research Council Proj. CAPA-5-68, 83p., June 1973. 14 refs.*

The distribution of hydrocarbons in the atmosphere was compared with that observed in sources and the degree to which the hydrocarbons of different reactivity participate in the photoreaction were estimated. Three flame ionization chromatographs were used to analyze 36 hydrocarbons from many locations around the country and some from overseas. Typical photochemical smog hydrocarbons consist of auto exhaust, gasoline vapors, natural gas, and background methane of 1.39 ppm. Spilled gasoline does not play a significant role. Samples taken near specific sources (petrochemical plants, brush fires, oil fields) show distinctly different distributions. Afternoon smog samples show substantial attentuation of the more reactive hydrocarbons. Oxidant smog in Riverside has undergone 6-8 hr of photochemical reaction. Irradiation produces continued reaction for 24 hr or more. In that time even hydrocarbons of low reactivity participate in the reactions. Higher aromatics (Carbon 8 +) are more reactive than previously thought. Benzilic hydrocarbons can be oxidized under atmospheric conditions to the potent eye irritant peroxybenzoyl nitrate. (Author summary modified)

41886 **APTIC NO. 63681**

Tokyo Metropolitan Government (Japan) Bureau of Environmental Protection

THE 1973 AIR POLLUTION CONTINUOUS MONITORING MEASUREMENT REPORT. *(Taiki osen joji sokuteishitsu sokutei kekka hokoku). Text in Japanese. 508p. June 1973.*

The entire computer printouts for June 1973 continuous air pollution monitoring and measurements for Tokyo are presented, with maps of the 20 monitoring stations. The contents and methods of automatic recording of pollutants were as follows: sulfur dioxide was measured by electroconductivity; oxidants were measured by neutral potassium iodide and absorption spectrophotometry; nitrogen oxides were measured by spectrophotometry with the Saltzman reagent; carbon monoxide was measured by the light-scattering method. The measurements were taken every hour on the hour. Automotive emission gases were monitored separately at 20 monitoring locations. There is no clear-cut pattern for the state of air pollution in Tokyo; but the SO2 measurements at monitoring stations seem to show a trend in a decrease of yearly averages for more recent years with the peak in 1966 and 1967.

41887 **APTIC NO. 63950**

Tokyo Metropolitan Government (Japan) Shibuya District Construction Pollution Dept.

REPORT ON AN ENVIRONMENTAL INVESTIGATION (INVESTIGATION OF AUTOMOTIVE EMISSION POLLUTION). *(Kankyo chosa (Jidosha kogai chosa) kekka hokokusho). Text in Japanese. 115p. Sept. 1973.*

The 1973 environmental investigation of automotive emission pollution in the Shibuya district of Tokyo is reported. The air quality measurements were taken for carbon monoxide and lead by infrared gas analyzer, and traffic amount, noise, oxidants, nitrogen oxides, temperature, humidity, wind direction, and wind velocity were measured. The hourly averages of traffic in several intersections were measured. Compared to the amount of traffic in 1971, the levels seem to show a decrease. In 1971, the hourly count of traffic ranged from 5100 to 7720; in 1973, the counts ranged from 3900 to 4500/hr. The highest lead measurement in 1970 was 5.6 micrograms/cu m, and in 1973, 1.8 micrograms/cu m. The CO levels in 1972 averaged at 13.30 ppm/hr, with the highest measurement of 18.4 ppm at one intersection. In 1973, the average was 10.86 ppm, with the highest measurement of 12.3 ppm. The health effects of various exhaust emission pollutants are discussed generally.

41888 **APTIC NO. 63952**

Yokohama Pharmaceutical Assoc. (Japan)

A TWO-DIMENSIONAL SURVEY REPORT ON AIR POLLUTION IN YOKOHAMA. (AUTOMOTIVE EXHAUST GAS--REPORT 2)(COMMISSIONED BY THE MUNICIPAL GOVERNMENT BUREAU OF ENVIRONMENTAL CONTROL). *(Yokohama-shi taiki osen heimen chosa hokokusho)(Jidosha haishutsu gasu - 2, Showa 47-nendo)(Yokohama-shi Kogai Taisakukyoku itaku chosa). Text in Japanese. 80p., 1973.*

For the purpose of grasping the distribution patterns of emission gases and sources and the state of pollution in Yokohama, carbon monoxide measurements were taken at 78 locations of Yokohama simultaneously for four consecutive days in September, October, and November 1972. The air was sampled by simple vinyl bags with a pump at the rate of 0.5 l/hr. The samples were then analyzed by non-dispersive infrared spectrometry. The number of vehicles was counted at each location every hour and half hour for five min and multiplied by six to get the hourly traffic. For the 19 locations that exceeded 10 ppm of CO in 1971, measurements were taken again in 1972, and the results were compared. Out of 19 locations, only two had less than 10 ppm, and 11 had 10-20 ppm, and six locations had more than 20 ppm. The maximum measurements of CO at 11 locations showed increasing tendencies, four locations showed decreasing tendencies, and five were at approximately the same level as 1971. The relationship between traffic and CO concentration showed about 3 ppm average for areas with 1000 vehicles/hr traffic, 6 ppm for 2000/hr, and 9 ppm for 3000/hr, and with more than 3500/hr, the average exceeded 10 ppm. But some fo the main roads had a 5 ppm concentration with 1000/hr vehicles, and more than 10 ppm with 2000/hr traffic. At 60 locations out of 78 checking points, the CO peaks appeared in the evening rather than in the morning or noon.

41889 **APTIC NO. 63955**

Tokyo Metropolitan Government, Pollution Control Bureau (Japan)

REPORT ON AIR POLLUTION CONTINUOUS MONITORING MEASUREMENTS. MAY 1973. *(Taiki osen joji sokuteishitsu sokutei kekka hokoku). Text in Japanese. 498p., May 1973.*

The entire computer printouts for May 1973 air pollution monitoring in Tokyo are presented with maps and numerical figures of 20 general monitoring locations. The data for automotive exhaust gases are presented separately, since the 20 monitoring locations are separate from the 20 general monitoring locations. The contents and methods of automatic recording for pollutants were as follows: sulfur dioxide was measured by electroconductivity; oxidants were measured by neutral potassium iodide and absorption spectrophotometry; nitrogen oxides were measured by spectrophotometry with the Saltzman reagent; carbon monoxide was measured by the light-scattering method. The measurements were taken every hour on the hour. Automotive emission gas (carbon monoxide) levels ranged between 1.9 and 5.8 ppm. The SO2 levels in May ranged from 1.0 to 3.3 pphm. The oxidant levels ranged between 2.1 and 4.6 pphm. The suspended particulates levels ranged between 2.8 and 7.8 mg/100 cu m. The NO2 levels ranged between 0.6 and 7.5 pphm, and NO levels ranged between 1.5 and 6.7 pphm.

41890 **APTIC NO. 64382**

Tokyo Metropolitan Government (Japan), Chuo District

ENVIRONMENTAL SURVEYS, 1972. *(Kankyo chosashu, Showa 47 nendo). Text in Japanese. 95p., Oct. 1973.*

Pollutants in the Chuo district were continuously monitored between April 1972 and March 1973. The methods of analysis were electroconductivity for sulfur oxides, light scattering for suspended particulates, absorption spectrophotometry, the Saltzman reagent for nitrogen oxides, and non-dispersive infrared analyzer for carbon monoxide. The wind direction and velocity were also measured. Automotive emission gases and noise levels were measured. The level of suspended particulates was 69 micrograms/cu m for the period with the highest measurement 355 micrograms/cu m and 15.4% of the total days failed to pass the environmental standards. The daily nitric oxide average was 7.6 pphm with the highest measurement 33.9 pphm. The daily average of nitrogen dioxide was 5.9 pphm, with the highest record 11.4 pphm. The daily fluctuation of NOx pattern changed with the season. While the courses of NO and NO2 were similar, with some variations in spring, summer, and fall, the level of NO was far greater than that of NO2 in winter, with two great peaks for NO at noon and midnight.

41891 **APTIC NO. 64411**

Kanagawa Prefectural Environmental Protection Center (Japan) Lab. for Public Nuisance and Kanagawa Prefecture Pharmaceutical Society (Japan) Public Health Branch

A SURVEY OF THE CONCENTRATIONS OF HEAVY METALS IN THE AIR OF KANAGAWA PREFECTURE. *(Kanagawa-kenka no taikichu jukinzoku nodo chosa). Text in Japanese. Kanagawa-ken Taiki osen Chosa Kenkyu Hokoku Tech. Rept. Air Pollution Yokohama-Kawasaki Ind. Area), no 15:25-41, Feb. 1973.*

Measurement of heavy metal pollution were made in 22 spots 6 times a year. Lead and cadmium were lower than the environmental standard. For Pb and Cd the highest values were in Yokohama and Kawasaki followed by the Shonan coast area and the middle part of Kanagawa Prefecture. High values of manganese and iron were found in Yokohama and Kawasaki. In terms of monthly variation in the concentrations of heavy metals, Cd, Pb, Mn, Fe and copper were high during the winter but low in July. Although correlated, the concentrations of heavy metals at ground level were higher than those made from the roofs of buildings. The highest concentration of heavy metal was registered in the afternoon, followed by night and early morning. Among heavy metals in dust at ground level, Fe had the highest concentration followed by zinc, Mn, Cu, Pb, and Cd. Good correlations could not be established between the concentrations of heavy metals in the air and those of dust at ground level.

1972

41892 **APTIC NO. 63578**

Brown, Dennis L.

SIZE DISTRIBUTION, MERCURY/LEAD CONCENTRATIONS, AND STOCHASTIC ANALYSIS OF SUSPENDED PARTICULATES IN AMBIENT AIR. *Air Force Inst. of Tech., Wright-Patterson AFB, Ohio, School of Engineering, GSF/MC/72-1, 89p., May 1972. 24 refs.*

NTIS, DDC: AD-748356

Particulate concentration, particle size distribution, and mercury and lead concentrations in atmospheric particulates on Wright- Patterson AFB, Ohio were determined. Samples were taken from three locations using an Anderson hi-volume sampler head mounted on a Staplex hi-volume sampler. Particulates were fractioned by the sampler head as follows: greater than 7.0, 3.3 to 7.0, 2.0 to 3.3, 1.1 to 2.0, and less than 1.1 micron in equivalent aerodynamic diameter. The distribution of the particulate concentrations was analyzed using the Reverse Arrangements test to establish randomness, the Kolmogorov-Smirnov test to compare 10 proposed probability density functions with the data collected, and the Likelihood Ratio test to isolate the function best describing the data. The mean particulate concentration was 85.1 micrograms/cu m, with a variance of 1048.2. Particulates under 1.1 micron composed an average of 31.3% of the total weight, those from 1.1 to 7.0 micron made up 31.9%, and those over 7.0 micron composed 36.8% of the sample. The average Pb concentration during a 24-hour sampling period was 1.25 micrograms/cu m; 50.9% of the Pb was in particulates under 1.1 micron. Mercury concentrations in particulates averaged 6.9 ng/cu m. No correlation was established between Hg concentration and particle size. (Author abstract modified)

41893 **APTIC NO. 63447**

Giles, W. H., R. E. Lee, and L. H. Dworetzky

PART I: THE INFLUENCE OF TRAFFIC-GENERATED CARBON MONOXIDE ON INDOOR AIR QUALITY OF AN AIR RIGHTS AND A CANYON STRUCTURE. *Preprint, General Electric Co., Philadelphia, Pa., Re-entry and Environmental Systems Div.; Environmental Protection Agency, Research Triangle Park, N. C., National Environmental Research Center; and General Electric Co., King of Prussia, Pa., Re-entry and Environmental Systems Div., 8p., 1972 (?). 5 refs.*

The indoor and outdoor levels of carbon monoxide were monitored continuously at a number of elevations of an air rights building and a canyon structure for 130 days each during portions of the heating and nonheating seasons. Concurrently, measurements of traffic volume and velocity, wind velocity and direction, and temperature were taken. Design criteria for minimizing the impact of traffic-generated pollutants on indoor levels of similar structures were developed from the resulting data. During the heating season, the concentration over the entire building was closer to the concentration at the lowest level nearest the traffic-generated source. The internal CO concentration profiles did not decay exponentially as did the external profiles. Therefore, during the heating season, the frequency of violating the National Ambient Air Quality Standards (NAAQS) was much higher internally than externally at the upper levels of the buildings. The higher frequency of exceeding the NAAQS in the canyon structure during the heating season was due to the closer proximity of this site to the source, slower traffic speed, shorter height of the building, and building construction. Since the stack effect is minimal during the nonheating season, the frequency of exceeding the NAAQS was equal to or slightly less internally than externally and decreased with increasing height. When the structure was oriented perpendicular to the predominant wind vector, the internal CO concentration was less than the external concentrations. (Author abstract modified)

41894 **APTIC NO. 63605**

Hertz, M. B.

RECAPITULATION OF EXPOSURES AROUND A POINT SOURCE OF AIR POLLUTION. *Preprint, Environmental Protection Agency, Research Triangle Park, N. C., Human Studies Lab., 6p., 1972 (?). 2 refs.*

A study was made in the Salt Lake Valley of the relationships between the health parameters of the Community Health and Environmental Surveillance System (CHESS) and a gradient of human exposure to sulfur dioxide. Four communities in or near the Salt Lake Valley were chosen to represent an exposure gradient to SO2, emitted primarily from a large copper smelter. The study communities, Magna, Kearns, Salt Lake City, and Ogden, are located approximately 5, 8, 13, and 35 miles from the smelter, respectively. Air monitoring sites were positioned approximately in the center of each study population. Total suspended particulates and their sulfate and nitrate fractions, SO2, and nitrogen dioxide were monitored daily, and dust fall concentrations were monitored monthly. Arithmetic mean SO2 and suspended SO4 concentrations showed that Magna had the highest levels, with Kearns, Salt Lake City, and Ogden following in that order. Past SO2 and SO4 exposures were estimated from annual smelter emissions; past exposures were considerably higher than present levels. (Author abstract modified)

41895 **APTIC NO. 64048**

Lisicka, I.

INVESTIGATION OF THE LEVEL OF LEAD CONCENTRATION IN THE ATMOSPHERIC AIR OF WARSAW. *(Badania poziomu stezen olowiu w powietrzu atmosferycznym Warszawy). Air Conserv. (English translation from Polish of: Ochrona Powietrza), 6(5):38-43, 1972.*

The level of lead concentrations in the atmospheric air of Warsaw was investigated based on 1700 readings made between 1968 and 1970. Lead was determined in over a dozen points in the city including high-traffic, residential, and green areas. The mean month Pb concentration at selected monitoring sites is listed. The area with the highest concentration was a narrow, heavily traveled street which includes a taxi parking site. Measurements were also made in 1970 at a number of other sites by thoroughfares. The highest concentration recorded was 2.2 micrograms/cu m. The Pb concentration at the mouth of a tunnel, although highest of all the mean values registered in the city, was still lower than expected. This may have been due to difficulties in setting up sampling equipment. Lead pollution can be reduced by marketing better fuel grades with minimal or no antiknock ingredients. The quanity of exhaust, and consequently Pb, in the air can also be reduced by changing traffic patterns.

41896 **APTIC NO. 64127**

Maj, U.

SPATIAL DISTRIBUTION OF SULFUR DIOXIDE AND DUST CONCENTRATION IN THE ATMOSPHERIC AIR. *(Przestrzenny rozklad stezen dwutlenku siarki i pylu w powietrzu atmosferycznym). Air Conserv. (English translation from Polish of: Ochrona Powietrza), 6(6):25-32, 1972. 5 refs.*

NTIS: TT 72-54023/6

The spatial distribution and sulfur dioxide and dust concentration levels at five measuring sites in the Katowice, Poland area for Sept. 1969 to July 1970 are presented. Statistical analysis confirmed the simultaneousness of changes in the concentrations of pollutants. The lowest levels of SO2 and dust were recorded at Zabkowice, outside the Upper-Silesian Industrial Region, while the highest concentrations were at Warsaw Street in Katowice and at Lipiny. The annual SO2 and dust concentration distributions were not entirely consistent. The maximum SO2 concentrations occurred in winter, the maximum dust concentrations in the fall. Minimum concentrations of both pollutants occurred in the summer. The correlation coefficients were 0.86-0.95 for SO2 and 0.37-0.86 for dust.

41897 **APTIC NO. 64021**

Nifong, Gordon D., Edward A. Boettner, and John W. Winchester

PARTICLE SIZE DISTRIBUTION OF TRACE ELEMENTS IN POLLUTION AEROSOLS. *Am. Ind. Hyg. Assoc. J., 33(9):569-575, Sept. 1972. 12 refs.*

Measurement of particle size distribution and composition of aerosols is investigated to identify source processes, evaluate their contribution to urban pollution levels, study particle transformation in the atmosphere, and define possible removal mechanisms. The importance of the composition of aerosols as a function of their size in determining mechanisms of their formation and in characterizing their source is stressed. Samples of industrial community atmospheres were collected by cascade impactor, and the particle size fractions were analyzed for 29 elements. Twenty-five of the elements fell into one of several observed groupings based on the size distributions of aerosols with which the elements were associated. Dispersive, condensation, and natural sources were thus indicated for various metals. Some elements (sodium, potassium, bromine, chlorides) rapidly approach a Junge distribution; others (iron, chromium, calcium, aluminum) do not. Primary particle size distributions determined by source processes may be modified by coagulation and sedimentation within the urban areas of East Chicago and Gary, Indiana which were studied. Gravitational settling and turbulent impaction are indicated as important mechanisms of aerosol removal by fallout. Elemental content of particulate size fractions can serve to establish natural tracers for certain emission processes.

41898 **APTIC NO. 65853**

Shigemo, Yoshiko, Tentaro Takahashi, Hiroaki Yamamoto, Takeshi Saito, and Mihoko Takahashi

ENVIRONMENTAL SURVEY IN THE VICINITY OF AN IRON FOUNDRY. *(Aru seitetsusho fukin no kankyo chosa ni tsuite). Text in Japanese. Iwate-ken Eisei Kenkyusho Nenpo (Ann. Rept. Iwate Inst. Public Health), no. 16(1973): 72-81, Dec. 1972.*

Many complaints were received about the settling particles emitted from an iron foundry in a village of Iwate Prefecture, and an investigation of the rice paddy soil disclosed a high content of cadmium. Further investigations were made on the metal content of drinking water, unhulled rice, liquid waste from the factory, and suspended particulates in the vicinity of the foundry. The investigation was conducted from July 1972 to July 1973 and Cd, copper, lead, and zinc were analyzed employing chlorine, nitric acid, DDTC-MIBK extraction, and atomic absorption spectrophotometry. The major source of Cd was the liquid waste from the smelting furnace. The suspended particulates contained a relatively small amount of heavy metals in relation to the total quantity of dusts. Of the total of 280 micrograms/cu m of dusts, Cd was 0.005 micrograms, Cu, 0.04, Pb, 0.10-0.20, and Zn, 0.22-0.27. The Cd content in unhulled rice was also less than 0.2 ppm, and the well water was also found safe.

41899 **APTIC NO. 63838**

Ishikawa Research Lab. for Public Health and Environment (Japan), Dept. of Environmental Science

SURVEY DATA OF AIR POLLUTION IN ISHIKAWA PREFECTURE, 1970-1971. *(Taiki osen chosa seiseki, Showa 45, 46-nendo). Text in Japanese. Ishikawa-ken Eisei Kogai Kenkyusho Nenpo (Ishikawa Prefect. Inst. Public Health), no. 9:78-119, March 1972.*

The air pollution status in Ishikawa prefecture was surveyed and analyzed by measuring the concentrations of settling particulates, sulfur oxides, carbon monoxide, nitrogen oxides and hydrocarbons during 1970 and 1971. The average settling particulate concentrations in Kanazawa were 9.5 ton/sq km/mo in 1970 and 7.3 ton/sq km/mo in 1971, decreasing in accordance with the nationwide trend. The settling particulate concentration is about 1/2-2/3 of that of the larger city. The SOx concentrations in Kanazawa measured by the lead dioxide method were 0.31 mg/100 sq cm/day in 1970 and 0.23 mg/100 sq cm/day in 1971, showing considerable decrease. The 3-day average SOx concentrations measured by the conductimetric method in 1971 were 12-18 ppb in the Kanazawa area, 5-8 ppb in the Kawakita area, 6-14 ppb in the Nanao area and 9 ppb in the Hasaku area. These figures are about 1/2-1/4 of the SOx concentration in Tokyo or Osaka and way below the environmental standard (0.04 ppm). The air pollution due to automobile exhaust gas was surveyed at intersections. The average 1-hr value of CO was 10.5 ppm and the maximum value was as high as 30 ppm, showing pollution comparable to that of a larger city. The nitrogen dioxide concentration was 0.04 ppm and the nitric oxide, SOx and HC concentrations were also high. The localized air pollution in intersection areas was at the level of larger cities. The overall air pollution problems in Ishikawa Prefecture are less serious than those of larger cities, and the pollutant levels are showing decreasing trends probably attributable to the various pollution control measures taken in recent years.

41900 **APTIC NO. 64180**

Commission of the European Communities, Directorates of Social Affairs, Industrial, Scientific and Technological Affairs, and Circulation of Goods

AIR LEAD CONCENTRATIONS IN THE EUROPEAN COMMUNITY. YEARLY REPORT: APRIL 1971-MARCH 1972. *(Der Atmosphaerische Bleigehalt in der Europaeischen Gemeinschaft. Jahresbericht fuer die Zeit von April 1971 bis Maerz 1972). Text in German. 167p., Sept. 1972.*

NTIS: EUR 4982 d,e,f,i,n

Results of systematic air lead concentration measurements conducted in the March 1971-April 1972 period in Belgium, France, West Germany, Italy, the Netherlands, and the United Kingdom are presented. The lead concentration measurements were performed in residential areas; areas with high traffic density; and special areas, such as traffic-affected and industrial areas. The analyses were done usually by atomic absorption spectrometric and dithizone colorimetric methods. The air lead concentrations measured in residential areas (some 6000 readings) ranged from zero to less than 3 micrograms/cu m. In areas with high traffic density, the lead concentrations reached nearly 10 micrograms/cu m. The lead concentrations in special areas were in the same order of magnitude as in residential areas. In small to medium-size towns, the monthly averages were below 1 microgram/cu m, while the daily averages were almost constantly below 2 micrograms/cu m. The yearly average was about 0.5 microgram/cu m. In rural areas, all monthly averages were below 0.5 microgram/cu m, and a few daily peaks were above 1 microgram/cu m. The monthly averages in big cities were often above 1 microgram/cu m, and the daily average was sometimes higher than 5 to 8 micrograms/cu m, while the yearly mean was below 2 micrograms/cu m. The air lead concentrations measured in areas with high traffic density wer consistently higher than those in residential areas, reaching up to 11 micrograms/cu m.

1971

41901 **APTIC NO. 63640**

Bourelly, T.

AIR POLLUTION AROUND A PETROLEUM REFINERY. *(La pollution atmospherique autour d une raffinerie de petrole). Text in French. Cahiers Centre Sci. Tech Batiment, no. 125: 1-8, Dec. 1971.*

Systematic monitoring of the acid and black smoke pollution around a petroleum refinery in the Paris region is in 1970-1971 is described. The samplings were conducted at four stations. The mean of the strong acid and black smoke concentrations was 20 micrograms/cu m, showing no significant departure from the means measured for the two preceding years. The monthly means for the strong acid and black smoke concentrations were 32 micrograms/cu m and 29 micrograms/cu m, respectively. The highest black smoke concentration was measured in mid-January with 168 micrograms/cu m, which was due to local emissions from the industrial zone. The highest daily mean of the strong acid concentrations was measured in early January with a peak of 214 micrograms/cu m. The hydrochloric acid concentrations were highest during winds from the industrial area. The operation of the petroleum refinery did not influence the pollution levels.

41902 **APTIC NO. 64187**

Bourelly, T.

AIR POLLUTION AROUND A PETROLEUM REFINERY. *(La pollution atmospherique autour d une raffinerie de petrole). Text in French. Cahiers Centre Sci. Tech. Batiment, no. 117:1-8, March 1971.*

Results of the systematic monitoring of high acidity and black smoke concentrations, conducted around the newly established petroleum refinery at Vernon in the Paris region from Sept. 1, 1969 to Aug. 31, 1970, are presented. The monthly averages of the black smoke and high acidity concentrations were 14.25 micrograms/cu m and 19.54 micrograms/cu m, respectively. During the monitoring period, the overall pollution level was fair both in the Paris region in general, and in the Vernon area in particular. Compared to the results obtained for the preceding years when the petroleum refining was not yet in operation, the black smoke and high acidity levels showed reductions by 39% and 29%, respectively, which was due to the favorable meteorologica conditions. The highest acidity level measured in early January was due an adjacent industrial area with an hydrochloric acid emission source.

41903 **APTIC NO. 64212**

Bourelly, T.

AIR POLLUTION IN THE PARIS REGION. JAN. 1, 1970 THROUGH DEC. 31, 1970. *(La pollution atmospherique dans la region Parisienne. 1er janvier 1970 - 31 decembre 1970). Text in French. Cahiers Centre Sci. Tech. Batiment, no. 120:1-10, June 1971.*

The black smoke and heavy acidity pollution in the Paris region in 1970 was measured. The monthly averages of black smoke and heavy acidity were 39.27 micrograms/cu m and 51.91 micrograims/cu m, respectively. The respective averages for January, February, and March were in the ranges of 29-90, 13-45, and 18-50 micrograms/cu m for black smoke, and 22-112, 10-87, and 23-109 micrograms/cu m for heavy acidity. During the cold season, a 27% reduction in black smoke pollution was observed compared with the 4 previous years, while the high-acidity pollution level was close to the average for these 4 years. An analysis of pollution dynamics over the last 5 years show that there has been a steady decrease in the black smoke pollution level, and very wide variations in the high-acidity pollution level from which no significant trend emerged. Despite the growing volume of the pollutant emissions by 22% for high- acidity pollution due to the combustion of fuel oil, the overall pollution level has tended to decline, which can only be due to favorable meteorological conditions. The 1970 data show an inverse relationship between temperature and sulfur dioxide concentrations, the powerful diluting effect of strong winds, and a drastic drop in pollution levels due to washout by precipitation.

41904 **APTIC NO. 65851**

Hirafune, Kiyohiko, Masanao Takahashi, and Akira Sato

STUDY ON ENVIRONMENTAL POLLUTION IN IWATE PREFECTURE--16TH REPORT ON METAL CONTENTS OF SUSPENDED PARTICULATES IN MIYAKO CITY. *(Miyako-shi no taikichu fuyu funjin no kinzoku seibun ni tsuite). Text in Japanese. Iwate-ken Eisei Kenkyusho Nenpo (Ann. Rept. Iwate Inst. Public Health), no. 14:(1970):78-83, Dec. 1971.*

Miyako is a fishing and industrial city of population 6000. Its soot emission sources are chemical fertilizer manufacturing plants, copper refineries, a sulfuric acid manufacturer, a silicon manganate alloy plant, and about 100 other small plants. The metal composition of suspended particulates was investigated in 1970 at six locations in the city. Quantitatively, the proportions of metals were, in descending order, iron, manganese, copper, lead, and cadmium. Previous reports had pointed out the unusually high proportions of Cd and Mn. In this investigation the measurements of Cd were 0.006-0.318 micrograms/cu m with an average of 0.054 micrograms/cu m in the air, and the findings were within the provisional standard for Cd (0.88 micrograms/cu m). The Mn measurements were 0.01 to 3.15 micrograms/cu m, with an average of 0.43 micrograms/cu m.

41905 **APTIC NO. 64119**

Wojciechowski, J.

POLLUTION OF THE ATMOSPHERE OF KATOWICE WITH VEHICULAR EXHAUSTS. *(Zanieczyszczanie atmosfery Katowic spalinami pojazdow mechanicznych). Air Conserv. (English translation from Polish of: Ochrona Powietrza), 5(2):50-56, 1971. 20 refs.*

NTIS: TT 72-54022/2

The results are given of measurements of instantaneous carbon monoxide concentrations by the conductometric method at some points in downtown Katowice, Poland. The highest daytime CO concentration was 19.6 ppm, the lowest 3.2 ppm. Mean CO concentrations were inversely proportionate with wind at wind velocities of 4.3 m/sec and higher. Automotive traffic was directly proportional to CO concentrations. The highest monthly mean CO concentrations was 21.2 ppm at the town square which had heavy traffic and the lowest CO concentration was 6.7 ppm at an area which had rapid diffusion of gaseous pollutants. Carbon monoxide concentrations of 0-10 ppm occurred 47.5% of the time, 10-15 ppm - 25.3%, 15-20 ppm - 11%, 20-25 ppm - 7.1%, 25-35 ppm - 5.1%, 35-45 ppm - 3%, and over 45 ppm - 1%. Higher concentrations determined with conductometry in 1970 than with iodometry in 1969 were not due to increased automotive traffic during the intervening period, but rather to the limited applicability of the iodometric method to this kind of research.

41906 **APTIC NO. 63630**

Prefecture de Police, Paris (France), Laboratoire Central

AIR POLLUTION STUDY IN PARIS AND ITS PERIPHERY IN 1970. *(Etudes de pollution atmospherique a Paris et dans les departements peripheriques en 1970). Text in French. Centre Interprofessionnel Technique d Etudes de la Pollution Atmospherique Rept. 36, 6p., April 1971.*

Results of systematic air pollution monitoring conducted in Paris and its vicinity in 1970 are presented. The average carbon monoxide concentration was with 15.2 ppm lower than the 1969 level. In certain points with high traffic density and frequent bottlenecks, concentrations of 30-40 ppm were measured. The average concentrations were usually higher than 15.5 ppm in the center city, and lower in the suburbs. While the average concentrations in underground structures were lower than in previous years, values up to 91 ppm were measured in certain parking lots. Automatic CO monitoring revealed highest concentrations during the morning and evening rush hours, and lowest concentrations on weekends and in August. The CO concentrations measured in the nearby of underground structures were not higher than 5.5 ppm. With arithmetic and geometric means of 26 micrograms/cu m and 30 micrograms/cu m, the nitrogen dioxide concentration peaked at 100 micrograms/cu m. The benzo(a)pyrene content in falling dust was higher than in preceding years, and values up to 56 mg/100 sq m were measured.

1969

41907 **APTIC NO. 64188**

Bourelly, T.

AIR POLLUTION IN THE PARIS REGION. THE 1967-68 CAMPAIGN. *(La pollution atmospherique dans la region Parisienne. Campagne 1967-1968). Text in French. Cahiers Centre Sci. Tech. Batiment, no. 96:1-12, Jan.-Feb. 1969.*

The results of systematic measurements of high acidity and black smoke in the Paris region conducted from April 1, 1967 to March 31, 1968 are presented. The monthly averages of black smoke and high-acidity concentrations were 40.82 micrograms/cu m and 39.06 micrograms/cu m, respectively. Variations in the daily pollution levels were greater for working days than they were for holidays. The daily mean concentrations were highest during periods of low wind speed. With the wind speed the same, the high-acidity levels were higher than the black smoke levels measured at the same time. On days when the 1-day pollution levels exceeded 100 micrograms/cu m, the wind speeds amounted to not more than about 50% of the mean wind speed. The daily pollution levels were highest in periods with winds blowing from Paris or its closest suburbs.

1968

41908 **APTIC NO. 63599**

Bourelly, Therese

AIR POLLUTION STUDY AT FOUR DIFFERENT LEVELS ON EIFFEL TOWER. PRELIMINARY RESULTS (1967). *(Etude de la pollution atmospherique aux quatre niveaux de la Tour Eiffel. Premier resultats (1967)). Text in French. Cahiers Centre Sci. Tech. Batiment, no. 91:1-10, April 1968.*

The concentrations and concentration variations of acid pollution and black smoke were studied at four different levels on the Eiffel Tower in Paris (at ground level, 57 m, 115 m, and 300 m) by systematic measurements of 3-hour concentration values. Reduction of the pollution level with increasing altitude and a comparable pattern of the dispersion of both acid pollutants and black smoke were observed. The acid pollutant levels were usually higher than the black smoke concentrations. Similarity in the monthly variations of both types of pollution was determined. The acid pollutant concentration was highest at 9 am and lowest at 8 pm at the three lower levels. The concentrations variations at the highest level were less pronounced, with a maximum occurring between 9 am and noon. The black smoke concentrations were lowest at 3 am at all levels. On the specific day when the pollutant level was highest, the maximum was reached at the same time at all levels, with the highest value measured at 57 m. The high pollution level was due to inversion and low cloud level below 300 m.

1967

41909 **APTIC NO. 64167**

Bourelly, T.

AIR POLLUTION IN THE PARIS REGION. *(La pollution atmospherique dans la region Parisienne). Text in French. Cahiers Centre Sci. Tech. Batiment, no. 84:1-16, Feb. 1967.*

Results of systematic monitoring of black smoke and high acidity concentrations, conducted in the Paris region from March 1965 to April 1966, and factors influencing the pollution levels in this area are presented. The monthly average black smoke and high acidity concentrations were 59.78 micrograms/cu m and 68.52 micrograms/cu m, respectively. The respective shares of domestic heating, industries, and thermal power plants, all burning fuel oil, in the yearly sulfur dioxide emission are 20%, 48%, and 32%. The rate of increase in the SO2 emissions due to the increased fuel oil expenditure in the winter period is identical in the domestic and industrial heating areas. While SO2 is continuously emitted by firing equipment, the emission volume is highest in winter, and lowest in summer. The air pollution levels decrease rather rapidly from Paris towards its suburbs. Taking the pollution level in Paris for 100%, the black smoke and high acidity concentrations in the less polluted zones 2 and 3 amounted to 75% and 55% for black smoke, and 82% and 32% for high acidity. Precipitation and strong winds rapidly and abruptly decreased the pollutant concentrations, while high pollution levels were measured in fog periods with limited dispersion. A correlation between the monthly average concentration and the frequency of wind blowing from Paris was established.

41910 **APTIC NO. 64189**

Bourelly, T.

AIR POLLUTION IN THE PARIS REGION. THE 1966-67 MEASUREMENT CAMPAIGN. *(La pollution atmospherique dans la region Parisienne. Campagne 1966-1967). Text in French. Cahiers Centre Sci. Tech. Batiment, no. 89:1-22, Dec. 1967.*

Results of the systematic monitoring of high acidity and black smok concentrations conducted in the Paris region in the period from April 1, 1966 to March 31, 1967 is presented. The monthly averages high acidity and black smoke concentrations were 42.22 micrograms/cu m and 52.2 micrograms/cu m, respectively. The pollutant concentrations decreased rather rapidly with increasing distance from the city. Notwithstanding, continuous winds with a more or less steady direction caused episodes of high black smoke and high-acidity concentrations in the suburbs. According to the average concentrations of black smoke and high acidity measured, Paris and its suburbs can be subdivided into three zones. Taking the pollution levels in zone 1 (city) for 100%, the black smoke and high acidity concentrations measured in the zones 2 and 3 correspond to 70% and 65% for black smoke,and to 77% and 31% for high acidity.

1962

41911 **APTIC NO. 634**

Meszaros, E.

CONCENTRATION MEASUREMENT OF ATMOSPHERIC CHLORIDE PARTICLES. *(Mesure de la concentration des particules de chlorures atmospheriques). Text in French. Czechoslovak Academy of Sciences, Aerosols, Phys. Chem. Appl., Proc. Nat. Conf., 1st, Liblice, Czechoslovakia, 1962, p. 529-534. 19 refs. (Oct. 8-13.)*

The concentration of atmospheric chloride particles in Hungary was studied with a microphotographic method after sampling in a Hagemann apparatus on a gelatin support. The chloride particle concentration averaged 18.5/l, and concentration over 200/l occurred during the invasion of maritime air masses, which is indicative of the maritime origin of the chloride aerosol in Hungary. Very few particles larger than 2 micron were found, and there were no giant particles necessary for the initiation of precipitation formation. The chloride particles were in liquid form under normal atmospheric conditions. Studies of chloride aerosols in Hungary can be used for the determination of the origin of air masses in Hungary.

41912 **APTIC NO. 63504**

Petera, V.

SMALL- AND MEDIUM-SIZE ION SPECTRUM MEASUREMENT IN INDUSTRIAL AREAS. *(Messung des Spektrums der Kleinen und mittleren Ionen im Industriegebiet). Text in German. Czechoslovak Academy of Sciences, Aerosols, Phys. Chem. Appl. Proc. Nat. Conf., 1st, Liblice, Czechoslovakia, 1962, p. 571-579. 2 refs. (Oct. 8-13.)*

Comparative measurements of the small and large ion spectra in a polluted industrial area and another less-polluted area in Czechoslovakia by means of a cylindrical suction condenser used as an ion counter are described. No significant differences in the numbers of ions pertaining to the same motility class, or in the positive-to-negative ion ratio for small and medium-sized ions were observed between the two different test areas. However, the electric conductivity was lower in the polluted area than in the less-polluted area. There was considerable difference between the electric conductivities caused by the positive and negative ions in the industrial area. In both areas, small ions were chiefly responsible for the electric conductivity that is determined by the mean motility. The mean motility of the negative ions was higher than that of the positive ions in both areas.

1951

41913 **APTIC NO. 63526**

Dyktor, H. G. and L. N. Goldston

THE EFFECTS OF THE STEEL INDUSTRY ON ATMOSPHERIC POLLUTION IN THE CLEVELAND AREA. *Ind. Hyg. Newsl., 11(2):22-23, Feb. 1951.*

Dust and gaseous pollutants in the air over Cleveland were measured during a steel strike in 1949 when the plants were closed and after the plants reopened to determine the effects of the steel industry on pollution. The monitoring program is reviewed including sampling methods, sampling procedures, and results. Sulfur dioxide concentrations during the steel strike ranged from 0 to 0.389, but one sample was 0.290-0.389 ppm in the southern area of the valley. After the strike, the range was 0-0.489, and only one sample was in the range of 0.390-0.489 ppm in the northern area of the valley. Mean SO2 concentrations during the strike and poststrike periods were, respectively 0.034 and 0.050 ppm. Fluorides during the strike were 0-50 micrograms; after the strike the range was the same. The mean fluoride concentrations, respectively, were 11.59 and 11.12 micrograms/cu m. While these contaminants did not seem to have been affected much by the absence or the presence of steel-making activities, there was an appreciable effect on soiling caused by dust. The overall soiling range during the poststrike period was roughly 50% greater than during the strike.

ATMOSPHERIC INTERACTION

1974

41914 **APTIC NO. 64406**

Baltrusch, M.

A THREE DIMENSIONAL ANALYSIS OF THE CO2 CONCENTRATION FIELD OVER AN AREA SOURCE. *(Dreidimensionale Analyse des CO2-Konzentrationsfelde ueber einer Flaechenquelle). Text in German. Arch. Meteorol. Geophys. Bioklimatol., Ser. B., 22(1/2):73-108, 1974. 42 refs.*

A procedure for measuring horizontal and vertical distributions of anthropogenic carbon dioxide in the industrial area Mannheim- Ludwigshafen with the aid of an instrumented aircraft is presented. The nature of the wind circulation on this are is investigated with special regard to diffusion using climatological data. A data processing procedure is described in which successive line-measurements of concentration are used to generate a complete description of the CO2-concentration field. For all stability classes, horizontal concentration distributions at different heights are mainly dependent on two groups of stacks with high emission rates (100,000 kg CO2/hr). From vertical profiles of horizontal wind velocity, values fo/the exponent m in the power law are calculated. These values differ only slightly from those of other authors. Because of the simple structure of the observed concentration fields a diffusion model was set up. The model is based on commonly accepted assumptions and rough average values of emission. The model is tested with measured CO2-fields. Measured and calculated concentrations agree quite well. The main source of error in the model-generated concentration fields is the innaccuracy of emission data.

41915 **APTIC NO. 64339**

Bartels, Hella

NECESSARY INVESTIGATIONS FOR EVALUATION OF THE EFFECTS OF COOLING TOWER OPERATION ON METEOROLOGICAL PARAMETERS. *(Notwendige Untersuchungen zur Beurteilung der Auswirkungen des Kuehlturmbetriebes auf meteorologische Parameter). Text in German. Elektrizitaetswirtschaft, 73(10):260-261, 1974.*

Cooling operations in power plants lead to problems with regard to environmental protection through emission of heat and water vapor. Liberated heat and water vapor affect the climate in the vicinity of the cooling tower. On the other hand formation, type, and extension of a steam plume of a wet cooling tower as well as buoyancy of the heat from a dry cooling tower depends largely on the prevailing weather conditions. The meteorological effects must be determined by theoretical and experimental methods. The experimental process is slow and takes several years. The theoretical methods are based on numerical models. Switzerland and the Federal Republic of Germany have developed models both of which use the vertical distribution of the air temperature, the relative humidity, and the wind as input. The greatest disadvantage of these models is the assumption of certain dispersion parameters of which no exact knowledge exists at present and which have great influence on the calculation. Confirmation of the models by extensive experimental measurements is urgently needed. For this purpose several measuring stations on the ground in the vicinity of a cooling tower should measure the temperature, humidity, precipitation, duration of sunshine, radiation, wind, and visibility. On a high tower in the lee of the main wind direction some meteorological elements should be measured in the vertical direction. These measurements would have to be complemented by photographs of the visible water vapor plume at all weather conditions. At certain weather conditions (at high pressure) balloon measurements should be taken. With the obtained data the theoretical models could then be checked and improved.

41916 **APTIC NO. 65778**

Benedetti-Michelangeli, G. and F. Congeduti

DETERMINATION OF VERTICAL EDDY DIFFUSION PARAMETERS BY DOPPLER OPTICAL RADAR. *Atmos. Environ., 8(8):793-799, Aug. 1974. 2 refs.*

The technique and preliminary measurements of the vertical eddy flux and the diffusion coefficient of aerosols in air are described. The measurements are based on the simultaneous determination, by Doppler optical radar, of the vertical aerosol velocity component, w, which is equivalent to the vertical wind velocity, and of the aerosol concentration. The determination of w is carried out by cross-correlating, for each scan, the spectrum of the reference signal with the spectra of the echoes received from different ranges.

41917 **APTIC NO. 65792**

Bolin, Bert, Goran Aspling, and Christer Persson

RESIDENCE TIME OF ATMOSPHERIC POLLUTANTS AS DEPENDENT ON SOURCE CHARACTERISTICS, ATMOSPHERIC DIFFUSION PROCESSES AND SINK MECHANISMS. *Tellus (Uppsala), 26(1-2):185-195, 1974. 10 refs.*

The sink mechanisms of atmospheric pollutants are discussed with emphasis on the relative importance of rain-out (washout) and dry deposition. The turbulent transfer processes that determine the latter are analyzed in the light of the classical theory for the atmospheric surface boundary layer. The transfer rates to the free atmosphere (where rain-out and wash-out are the sink mechanisms) and to the earth's surface (when dry deposition occurs) are computed as dependent on height of emission, roughness of the earth's surface, deposition velocity (or accommodation efficiency) at the earth's surface, and the intensity of the turbulent processes (as dependent on wind velocity). On the basis of such computations the residence time of atmospheric pollutants are computed. The relative importance of rain-out (wash-out) and dry deposition is discussed. (Author abstract modified)

41918 **APTIC NO. 64181**

Clarke, John F. and James L. McElroy

EFFECTS OF AMBIENT METEOROLOGY AND URBAN MORPHOLOGICAL FEATURES ON THE VERTICAL TEMPERATURE STRUCTURE OVER CITIES. *Environmental Protection Agency, Research Triangle Park, N. C., Meteorology Lab., Rept. 74-73, 21p., 1974 (?). 11 refs.*

The vertical temperature structure over cities during nocturnal hours is discussed relative to that over adjacent rural environs using experimental data collected over two metropolitan areas of different size -- Columbus, Ohio and St. Louis, Missouri. Ten pairs of comparative urban-rural profiles of temperature are presented for each of these cities to delineate influences on the urban temperature structure of ambient meteorological conditions in the upwind rural area and of urban morphological factors like city size, local surface fabric, and waste heat emissions. A pronounced modification of the low-level temperature structure over the cities occurred. A relatively unstable layer existed adjacent to the surface, i.e., the urban boundary layer. Above this layer, the temperature structure was similar to that in the surface layer of the rural environs upwind of the city. The structure of the boundary layer was generally more complex, and its mean thickness greater, over St. Louis than over Columbus. The former may reflect the passage of air over significant and radically differing land use areas prior to its arrival at urban sounding sites in St. Louis in comparison to Columbus. The latter was probably due in part to the overall persistence of more stable ambient meteorological conditions during the Columbus experiments. A compilation of data showed the existence of a significant relationship between the thickness of the urban boundary layer and the inverse of the square root of the potential temperature gradient in the surface layer of the upwind rural area as suggested by Summers. Also indicated was a minimum boundary thickness under stagnation conditions of about 50 m for Columbus and somewhat less than 75 m for St. Louis, a larger city. Boundary layer thicknesses in the region near center city were estimated from the dry adiabatic extension of the maximum urban surface temperature to the upwind rural sounding, i.e., mixing layer concept. (Author abstract modified)

41919 **APTIC NO. 65858**

Cox, R. A.

PARTICLE FORMATION FROM HOMOGENEOUS REACTIONS OF SULPHUR DIOXIDE AND NITROGEN DIOXIDE. *Tellus (Uppsala), 26(1-2):235-240, 1974. 20 refs.*

The conversion of gaseous sulfur dioxide and nitrogen dioxide into particulate material and its implication on the atmospheric chemistry of these gases is discussed. Homogeneous oxidation of SO2 by photochemically initiated reactions may occur at a rate ranging from 0.1%/hr in clean air to a 0-10%/hr in urban air. The oxidation rate of NO2 is more rapid (up to 25%/hr), but may be effectively less due to the reversible nature of the reactions. The rate of formation of sulfuric acid in urban air (from SO2) is sufficient for heteromolecular nucleation to form aqueous H2SO4 aerosols. In background areas condensation on the existing aerosol is the main fate of the SO2 oxidation products. Sufficient gaseous nitric acid for nucleation is unlikely to be produced from NO2 in the atmosphere and condensation on aerosol particles, particularly hygroscopic particles, is an important removal mechanism for HNO3. A large effect of relative humidity on the rate of the nucleation and condensation processes is demonstrated experimentally. (Author abstract modified)

41920 **APTIC NO. 66081**

Dirks, Richard A.

URBAN ATMOSPHERE: WARM DRY ENVELOPE OVER ST. LOUIS. *J. Geophys. Res., 79(24):3473-3475, Aug. 20, 1974. 9 refs.*

Airborne meteorological observations were made over St. Louis during the months of Aug. 1971-1973 as part of Project Metromex. On generally clear summer days, an excess of sensible heat and a reduction in moisture were observed in the atmosphere overlying the urban area. These anomalous fields extended to a considerable height and were displaced downwind by the ambient airflow. The reduction in evaporating surface accounts for a significant reduction in evapotranspiration over the urban area. (Author abstract modified)

41921 **APTIC NO. 63914**

Fukuoka, Saburo, Mitsue Kyoda, and Toshio Odaira

SEA BREEZE FRONT AND EXTENSIVE POLLUTION BY OXIDANTS. *(Kaifu ensen to okishi danto koiki osen). Text in Japanese. In: Studies on Tokyo Smog. Tokyo Metropolitan Research Inst. for Environmental Protection (Japan), Rept. 3, p. 466-488, March 1974. 2 refs.*

From the data on oxidant pollution in the Kanto area compiled during 1972 and 1973, 10 extensive oxidant pollution days, 5 in 1972 and 5 in 1973, were selected and analyzed in relation to the meteorological conditions. The wind trajectory map and oxidant pollution distribution at 8, 10, 11, 12, 13, 14, 15 and 17 hours and the diurnal variation in oxidant concentration are shown in diagrams. The extensive oxidant pollution in southern Kanto is governed by complex interacting factors such as sea breeze, insolation, atmospheric stability, and wind velocity. The oxidant concentration in the Tokyo bay area is affected more by atmospheric stability than wind direction at ground level, and the higher oxidant concentration tends to appear on a day with high atmospheric stability and sufficient insolation, regardless of the sea breeze velocity. The high oxidant concentration occurs in both sea breeze and land breeze areas, but is more likely to occur in their convergence area. The stagnant sea breeze front generally delayed the peak oxidant concentration time and retained high oxidant concentrations. The velocity of sea breeze front of the day is a useful information for oxidant pollution forecasting of the day, particularly for inland forecasting.

41922 **APTIC NO. 63915**

Fukuoka, Saburo, Mitsuru Utagawa, Masashi Ito, Hisao Nakaura, Mitsue Kyoda, Toshio Odaira, Minoru Moriguchi, Mitsuzo Shintani, Uosuke Ishii, and Yoshihiro Watanabe

THE CHARACTERISTICS OF AIR CURRENTS NEAR THE TOKYO AREA GROUND SURFACE. *(Tokyo shuhen no chihyo fukin no kiryu no tokucho). Text in Japanese. In: Studies on Tokyo Smog. Tokyo Metropolitan Research Inst. for Environmental Protection (Japan), Rept. 3, p. 489-504, March 1974.*

The characteristics of ground level temperature affecting the air current in the Tokyo area were studied. When the wind is weak in the gathering area of the sea breeze front, the vertical current is usually changing. The rising and descending current velocities are generally 1/5-1/10 of the horizontal air current velocity, with some high speeds of 2-3 m/sec. The rise and fall of the air current and the increase and decrease of the ground surface temperature generally correspond. Often, the air is descending in the cooling areas of rivers and green areas, and the air is ascending above the suburban cities with heat islands. The relationship between the air current and ozone concentration was examined, and the pollutant concentration fluctuations caused by the horizontal air movement was generally great, but the relationship with the vertical movement was not clear. The ground surface temperature distribution in Tokyo showed that the temperature in the busy commercial central districts was about 5 C higher than the suburbs. But in the areas of Hachioji, Arakawa, and Aome (suburban cities), isolated high temperature zones were found.

41923 **APTIC NO. 66036**

Georgii, H. W. and W. J. Mueller

ON THE DISTRIBUTION OF AMMONIA IN THE MIDDLE AND LOWER TROPOSPHERE. *Tellus (Uppsala), 180-184, 1974. 11 refs.*

Ammonia and sulfur dioxide were sampled under pure air conditions over West Germany by aircraft ascents and measured by application of the indophenol blue method after Bertheolot. The vertical distribution of NH3 is typical of that of a trace gas with the source at the ground. The SO2 content of the lower troposphere, in contrast with NH3, is higher during winter than during summer due to higher anthropogeneous SO2 production. At altitudes above 200 m the summer, concentration of NH3 is of the same order of magnitude as the SO2 concentration. During winter the NH3 concentration is much below the SO2 content of the middle troposphere. Only during the warm seasons is the supply of NH3 to higher levels for the NH3-SO2 liquid water reaction which leads to the formation of ammonium sulfate aerosols.

41924 **APTIC NO. 64340**

Gloria, H. R., G. Bradburn, R. F. Reinisch, J. N. Pitts, Jr., J. V. Behar, and L. Zafonte

AIRBORNE SURVEY OF MAJOR AIR BASINS IN CALIFORNIA. *J. Air Pollution Control Assoc., 24(7):645-652, July 1974. 22 refs.*

An instrumented aircraft was used to study photochemical air pollution in California. Simultaneous measurements were made of ozone, total oxidant, hydrocarbons, and nitrogen oxides, as well as of several meteorological variables. Pollutants were concentrated in many distinct layers up to at least 18,000 ft; in many of these layers, the pollutant concentrations were much higher than at good levels. The presence of stable air inhibited the dilution of air masses for distances of 30 mi or more. Ozone and total oxidant layers below 10,000 ft seemed to be the result of air pollutant emissions and their subsequent photochemistry and of the meteorological structure of the atmosphere. Total oxidant layers above 15,000 ft might have been due to stratospheric intrusion of O3 into the troposphere. Although oxidant and O3 levels were low at ground level, they often increased by factors of from 2 to 10 at higher altitudes. Ground level emissions such as HC and NOx tended to dilute as the air mass mixed and rose to higher altitudes. Ozone buildup was primarily the result of continuous photochemical aging of the air mass. The smaller ground level O3 measurements were probably the result of physical quenching on surfaces and/or chemical quenching by nitric oxide and olefinic HC. An isothermal temperature profile in the Los Angeles Basin was common during smog episodes. High total oxidant levels relative to lower O3 measurements could result from oxidation reactions resulting from NO emissions by fossil fuel power plants. The reaction of NO with O3 tended to retard O3 buildup and to lead to high levels of nitrogen dioxide. Studies of air masses advected over the Pacific Ocean indicated that despite the presence of immeasurably low concentrations of other pollutants, O3 concentrations in an aged air mass could build to levels on the order of 0.08-0.14 ppm and that background O3 levels as low as 0.003 ppm could be recorded. Meteorological transport mechanisms were better portrayed by vertical than by horizontal pollutant profiles. Ground level data was insufficient to provide a complete understanding of photochemistry and transport. (Author conclusions modified)

41925 **APTIC NO. 65849**

Grover, R.

HERBICIDE ENTRY INTO THE ATMOSPHERIC ENVIRONMENT. *Chem in Can., 26(7):36-38, 1974. (Presented at the 2nd Meeting on Herbicide Chemistry and Biochemistry, CIC, March 4-5, 1974, Regina, Saskatchewan.)*

The environmental hazards from the drift of herbicides as droplets which occurs during application and to the losses by voltality which may occur both during and immediately following an application are discussed. Atmospheric monitoring data collected over the past decade in Saskatchewan show that the high volatile butyl esters constitute the predominant form of 2,4-D in the air. It was detected about 50% of the time at levels between 0.01 to 1 micrograms/cu m of air. It seldom exceeded 5 micrograms/cu m. Conventional field spraying with ground sprayers emit about 5% of herbicides in droplet drift and about 30% in vapor loss. Much greater drift hazards exist from the vapor losses than from the droplet drift. An increase in wind speed increases droplet drift.

41926 **APTIC NO. 66040**

Hales, J. M., J. O. Wilkes, and J. L. York

SOME RECENT MEASUREMENTS OF H2S OXIDATION RATES AND THEIR IMPLICATIONS TO ATMOSPHERIC CHEMISTRY. *Tellus (Uppsala), 26(1-2):277-283, 1974. 25 refs. (Presented at the International Symposium on Atmospheric Trace Gases, Mainz, Germany, April 1, 1973.)*

Measurements on the hydrogen sulfide ozone reaction rates are discussed. They predict typical H2S lifetimes of the order of months which is much too long for this reaction to be a significant mechanism of atmospheric removal. The H2S O3 reaction is expected to proceed homogeneously in the atmosphere with catalytic effects of little or no importance. The reaction proceeds thermally; light in the visible region does not affect its rate appreciably. Some mechanisms other than ozonation must be responsible for atmospheric breakdown of reduced sulfur compounds. Evidence is discussed which supports the theory of photochemical oxidation of H2S by nitrogen oxides. (Author abstract modified)

41927 **APTIC NO. 66085**

Harvey, George R. and William G. Steinhauer

ATMOSPHERIC TRANSPORT OF POLYCHLOROBIPHENYLS TO THE NORTH ATLANTIC. *Atmos. Environ., 8(8):777-782, Aug. 1974. 13 refs.*

Atmospheric polychlorobiphenyl concentrations over the western North Atlantic are reported from experiments utilizing a new collection technique along with gas chromatographic analysis. The sampling system consists of a hurricane air pump fitted with a 102 mm filter holder on the intake port. An 0.3 micron glass fiber filter, baked at 500 C for 12 hr is used on the intake, and the filter holder chamber behind the filter is filled with 0.25 in. ceramic saddles which are coated with 0.25% OV-17 silicone oil. Concentration data are given for 13 samples and indicate that the collection method can only approximate the relative concentrations of chlorinated hydrocarbons in the particulate and vapor-aerosol phase. Polychlorobiphenyl concentration is observed to decrease exponentially with distance from land, with wind transport being concluded as the major source of the chlorinated hydrocarbons in the ocean.

41928 **APTIC NO. 64363**

Ishikawa, Seiji, Yasuhiro Morita, Masahiro Kaneda, and Masumi Takagi

OBSERVATION OF ATMOSPHERIC ELECTROCONDUCTIVITY AND AEROSOLS BY BALLOONS. *(Denki dendodo erozoru no kikyu kansoku). Text in Japanese. Taiki Denki Kenkyu (Proc. Soc. Atmos. Electr. Jap.), no. 10:1-5, Feb. 1974. 4 refs.*

Actual measurements of vertical distribution of atmospheric electric parameters (electroconductivity and ion density) showed deviations from the vertical distribution of parameters obtained by calculations based on the assumption of ionization equilibrium in a clean atmosphere. The deviation from the calculated value is prominent at altitudes below 10 km and above 17 km, which are presumably attributable to the presence of aerosols in the case of the former and the presence of ozone in the case of the latter. The simultaneous measurements of electroconductivity and aerosols, the variation in electroconductivity due to the effect of aerosols smaller than 0.1 micron, and the density of aerosols larger than 0.3 micron in the stratosphere, were carried out using a balloon equipped with the conductivity meter and aerosol counter on October 10, 1973. The deviation distribution at altitudes below 10 km and aerosol particulate density (larger than 0.3 micron) distribution showed parallel variations; however, the aerosols affecting the conductivity are those in the submicron ranges. A certain degree of correlation was found between the particulate density (larger than 0.3 micron) and deviations in conductivity at altitudes between 5 and 10 km; however, no correlation was found at altitude above 10 km or below 5 km, indicating that the deviation at altitudes above 10 km is not attributable to the effect of aerosols

41929 **APTIC NO. 66037**

Jost, D.

AEROLOGICAL STUDIES ON THE ATMOSPHERIC SULFUR BUDGET. *Tellus (Uppsala), 26(1-2):206-212, 1974. 29 refs.*

The atmospheric concentrations of sulfur dioxide, ammonia, sulfate ion, hydrogen sulfide, and heavy metals were investigated under different meteorological situations and air masses using aircraft ascents. From the measurements, the influence of clouds and sun radiation on the atmospheric SO2 concentration can be estimated. Sulfur dioxide residence time in the atmosphere ranges from about 1 hr to several days as it is calculated from the concentration distribution of several trace substances (SO2, carbon dioxide) in the troposphere. Sulfur dioxide and its reaction products are omnipresent air pollutants in the troposphere over Europe. The concentration relation sulfate ion sulfur/SO2 sulfur shows specific variations from summer to winter. (Author abstract modified)

41930 **APTIC NO. 63956**

Kitagawa, Tetsuzo

PHOTOCHEMICAL SMOGS IN THE LOS ANGELES AREA AND THEIR SOURCES. *(Rosu anjerusu chiiki ni okeru kokagaku sumoggu to sono hasseigen). Text in Japanese. Anzen Kogaku (J. Japan Soc. Safety Eng.), 13(3):174-188, June 1974. 25 refs.*

Photochemical oxidant formation from factory and automobile exhaust gas accumulated in the mixed layer under an inversion layer is the major cause of photochemical smog formation in Los Angeles area. However, the oxidant pollution in the distant San Bernardino and Riverside counties can not be explained by this theory. The data on oxidant concentration measured at 30 locations in Los Angeles, Orange, San Bernardino, and Riverside counties were analyzed in relation to the prevailing wind in the summer. Smog formation in the distant areas and other phenomena unexplainable by the existing theory were attributable to aircraft exhaust gas emitted in the inversion layer. The data on the composition, volume, and concentration of aircraft exhaust gas, air traffic volume, and air traffic route were analyzed in relation to the oxidant concentration. The photochemical reaction takes place in the inversion layer, and the oxidant formed is carried downward by the sea wind increasing the oxidant concentration at the ground level.

41931 **APTIC NO. 64322**

Kondrat ev, K. Y. and O. I. Smoktiy

THE EFFECT OF AEROSOLS ON RADIANT HEAT FLOW IN THE ATMOSPHERE. *(O vliyanii aerozolya na luchistyy pritok tepla v atmosfere). Text in Russian. Izv. Akad. Nauk SSSR, Fiz. Atmosfery i Okeana, 10(2):195-201, May 1974. 7 refs.*

The effect of atmospheric aerosol on thye spectral transmission function and the spectral albedo of the atmosphere-earth surface system was studied theoretically, and related calculated and measurement data are presented. The energy absorbed by the atmosphere in the visible range is considerably influenced by the optical parameters of the aerosols, the zenith angle of the sun, and the albedo of the earth surface. The increase in the atmospheric aerosol concentration resulted in a wider range of variation in the absolute values of the monochromatic radiant influx. Good agreement between calculated and measured values of the radiant heat influx at 500 nanom wavelength over a sandy surface was established.

41932 **APTIC NO. 66078**

Leahey, Douglas M.

A STUDY OF AIR FLOW OVER IRREGULAR TERRAIN. *Atmos. Environ., 8(8):783-791, Aug. 1974. 15 refs.*

Results are presented from a diffusion experiment conducted along a river bank 52 m in height, with the pollution source being a coal-fired thermoelectric power station. Wind measurements indicate that air flowing over river banks of moderate slope may parallel the terrain and that turbulence is greater over such features than over regular topography, causing faster dispersion of plant plumes. Ground level sulfur dioxide concentrations which might result from power plant plumes flowing over a river bank are predicted with a Gaussian model, and observed SO2 concentrations during moderately strong winds on high ground above the river plant are found greater than expected on the basis of the usual Pasquill coefficients. Larger derived coefficients are used to obtain a closer prediction of the SO2 concentrations.

41933 **APTIC NO. 65827**

Lockeretz, William

DEPOSITION OF AIRBORNE MERCURY NEAR POINT SOURCES. *Water, Air, Soil Pollut., 3(2):179-193, June 1974. 32 refs.*

The deposition of mercury emitted into the atmosphere by a power plant and an incinerator is calculated. Separate results are presented for wet and dry scavenging processes acting on both the adsorbed and vapor phases. Some localized deposition occurs, leading to a slow increase in the Hg levels of soil and surface runoff, but most of the emission remains airborne for relatively long distances, typically tens of kilometers. A model of atmospheric Hg transport is presented, and computational techniques are discussed in the appendix. Transport processes discussed include adsorption on particulates, direct capture of Hg vapor by soil, evaporation of soil Hg, solubility of Hg vapor in rainwater, meteorological conditions during precipitation, and movement of Hg through soil. Deposition from strong point sources is not markedly different from the average from artificial sources. Only a small part of the total is deposited locally compared to the distance between sources. Even for the incinerator, which has more localized deposition than the power plant, 4/5 of the Hg remains airborne to combine with emissions from other sources. Thus, deposition at a given point may be from several sources, including some fairly distant ones, not just from a few that are close. (Author abstract modified)

41934 **APTIC NO. 65871**

McCallister, Michael Alan

A THEORETICAL STUDY OF METEOROLOGICAL EFFECTS ON THE DISPERSION OF ATMOSPHERIC CONTAMINANTS IN THE COASTAL ENVIRON-

MENT. *Naval Postgraduate School, Monterey, Calif., Thesis (M.S.), March 1974, 64p. 38 refs.*

NTIS: AD 776281

Present numerical models describing pollutants diffusion employ two main approaches to the problem: Gaussian bivariate distributions based on the statistical properties of atmospheric flow which have the advantages of simplicity and computational economy; and numerical simulations of diffusion, based on the continuity equation and conservation reactions, which allow a more precise description of atmospheric turbulent flow. Numerical models of each method are examined. The governing equations are discussed, with basic assumptions which permit reasonable simplications to be made. Results of both models are examined qualitatively to describe patterns of marine-layer pollutant dispersal. Calculations from both models reveal wind velocity to be the most critical atmospheric characteristic controlling dispersion. Rates of spreading are also closely related to other measurable meteorological properties such as thermal stability and mixing depth. (Author abstract)

41935 **APTIC NO. 63911**

Moriguchi, Minoru, Mitsue Kurose, Saburo Fukuoka, Toshio Odaira, and Masauasu Muraoka

OXIDANT CONCENTRATION AND METEOROLOGICAL CONDITIONS. *(Ox nodo to kisho joken). Text in Japanese. In: Studies on Tokyo Smog. Tokyo Metropolitan Research Inst. for Environmental Protection (Japan), Rept. 3, p. 407-435, March 1974. 2 refs.*

The relationships between the average oxidant concentration and standard deviation and meteorological factors were statistically analyzed. The temperature range was divided into three categories, and the data on average oxidant concentration and standard deviation at corresponding temperatures were compiled at nine locations from April to August. In Tokyo, the occurrence of oxidant concentrations was more frequent at a median temperature range and in the littoral area the average concentration tended to be lower at higher temperatures contrary to the case of Los Angeles. The 3-hour insolation value measured between 10:00 and 12:00 was classified into three categories, and the diurnal variation in average oxidant concentration was measured in the corresponding category. The average oxidant concentration is generally higher at the higher insolation value, and the day s maximum oxidant concentration appears much later in the day when the insolation value is low. The analysis on the insolation and wind velocity indicates that the wind velocity is generally higher at the higher insolation value. The relationship of the occurrence frequency of high oxidant concentration to the wind velocity and insolation indicated that the high oxidant concentration tended to appear at high insolation and low wind velocity in April, May and June only infrequently. In July and August, however, the high oxidant concentration was observed in almost all occasions when the meteorological conditions were appropriate. The relationship between wind velocity and oxidants is that the higher the wind velocity, the lower the oxidant concentration as expected. The atmospheric stability based on the insolation and wind velocity was classified into four categories, and the relationship with oxidants concentration was studied. High oxidant concentration tended to occur in the most unstable atmospheric conditions.

41936 **APTIC NO. 63912**

Nakaura, Hisao, Saburo Fukuoka, Masashi Ito, Mitsue Kurose, and Toshio Odaira

VERTICAL DISTRIBUTION OF PHOTOCHEMICAL SMOG-RELATED POLLUTANTS. *(Kokagaku sumoggu kanren osen busshitsu no enchoku bunpu). Text in Japanese. In: Studies on Tokyo Smog. Tokyo Metropolitan Research Inst. for Environmental Protection (Japan), Rept. 3, p. 436-465, March 1974.*

For the purpose of investigating the photochemical smog pollution mechanism, the vertical distribution of oxidants, nitrogen oxides, and sulfur dioxide were measured at 100, 200 and 300 m along with meteorological conditions from July 25 to 31, 1972. The pollution mechanism of primary and secondary pollutants is different in the following respects; the formation of secondary pollutants requires a certain amount of reaction time, and the secondary pollutants are readily decomposed, particularly by the effect of primary pollutants at ground level. The variation in ozone concentration at higher altitudes generally corresponded to that of the ground level. The variation in vertical distribution is slight when the oxidant concentration at ground level is low. At low wind velocity, the horizontal distribution of O3 concentration in relatively small area shows marked variation, probably attributable to the decomposition of O3 by the randomly distributed primary pollutants. Also at low wind velocity, the O3 concentration above the lower boundary of inversion layer was lower, while the concentration below the boundary was markedly higher. However, no quantitative relationship was found between O3 concentration and the altitude, thickness or intensity of inversion layer. At high wind velocity, the effect of atmospheric stability on O3 concentration is slight, and marked variations in vertical and horizontal distribution are observed. The integrated nitrogen dioxide concentration at 700 m was higher in the littoral area and lower in the inland.

41937 **APTIC NO. 63935**

Odaira, Toshio and Saburo Fukuoka

INVESTIGATION AND RESEARCH ON POLLUTANT TRANSPORTS BY LOCAL AIR CURRENTS. *(Kyokuchi kiryu ni yoru osen busshitsu no iryu ni kansuru chosa kenkyu). Text in Japanese. In: Studies on Tokyo Smog. Tokyo Metropolitan Research Inst. for Environmental Protection (Japan), Rept. 3, p. 742-767, March 1974.*

Air pollutant concentrations were measured at 24 locations in the Tokyo suburb of Shakujii covering about 1 sq km, for three days in August 1972. The ground concentration and the lower atmosphere concentration were measured by altitude and local air movements were observed. The traffic on the Aome Highway was stopped for one day to see the effects of limited traffic on pollution. Along the highway, relatively high concentrations of nitric oxide, carbon monoxide, and nonmethane hydrocarbons were found on days of normal traffic, and the levels of these pollutants were definitely lower on the day the traffic was limited. But 100 m away from the highway, the pollution level was very low regardless of the amount of traffic, and there was no geographical difference between measurements of monitoring points. In a weak wind, a slight turbulence difference was noted between building roofs and schoolyards. Affected by trees and buildings, the air current in open spaces such as schoolyards often change, and this was not considered an extraordinary local phenomenon. The limitation of traffic did not affect the levels of sulfur dioxide, nitrogen dioxide, and ozone, and these levels remained high. This was conjectured to be the effect of a large area pollution from other parts of Tokyo. High concentrations appeared at 50-100 m and around 200 m from the ground.

41938 **APTIC NO. 63638**

Oden, Svante and Bjorn Berggren

PCB AND DDT IN BALTIC SEDIMENTS. *Preprint, Agricultural College, Uppsala (Sweden), Dept. of Soil Science, 10p., 1974 (?).*

The concentrations of PCB (polychlorinated biphenyls) and DDT were measured in different sediments from lakes, rivers, ditches, polluted harbors, and the Baltic Sea. In all samples in 1968, the content of PCB was below the detectable limit and DDT ranged from 1 to 10 ng/g dry matter (10 to the -9th power). Thus, a very low degree of contamination of the sediment occurred. The ratio DDE:DDD:DDT was approximately 1:1:10 for samples taken from the Central Baltic in 1968 and those from the Gulf of Bottnia in 1973. This indicated the same kind of source for the DDT compounds and the same degree of metabolic activity in these water bodies. In 1972 in the Baltic proper, DDD was the dominating compound because of prolonged reducing conditions in the sediments and water which favored transition from DDT to DDD. In 1972, DDT concentrations increased to 45 ng/g on the average and PCB increased to around several hundred ng/g dry weight. High concentrations of PCB in Baltic sediments far from local coastal sources led to the hypothesis that PCB is added to water by atmospheric fallout, local sources (industry and sewage plants), and coastal dumping of sewage sludge. The transport and sink process for the pesticides is described.

41939 **APTIC NO. 66038**

Penkett, S. A. and J. A. Garland

OXIDATION OF SULPHUR DIOXIDE IN ARTIFICIAL FOGS BY OZONE. *Tellus (Uppsala), 26(1-2):284-290, 1974. 17 refs.*

The rate of oxidation of sulfur dioxide by ozone was measured in a fog chamber designed to simulate atmospheric concentrations. At 10 C the rate was proportional to the first power of the O3 concentration, and its absolute value was in agreement with that calculated from data obtained on the reaction between O3 and bisulfite ions in water using the stopped-flow method. The reaction at an O3 concentration of 0.05 ppm was substantially faster than the reaction of SO2 with air alone in the fogs. The O3 reaction is sufficiently rapid to account for most observations of sulfate levels found in cloud and rain water. (Author abstract modified)

41940 **APTIC NO. 63756**

Pittock, A. B.

TRENDS IN THE VERTICAL DISTRIBUTION OF OZONE OVER AUSTRALIA. *Nature (London), 249(5458):641-643, June 14, 1974. 14 refs.*

Soundings of the vertical ozone distribution were madde on a weekly basis at Aspendale, Australia since 1965. Estimated trends are based on at least squares linear regression against time of 48 successive deviations of 2-month mean ozone partial pressures for each of 36 standard levels from 1000 mbar to 10 mbar. Ozone trend estimates in various layers of the atmosphere in units of reduced thickness of ozone per decade were -0.0099 total, -.0027 for 0-10 km layer, -.0067 for 10-20 km layer, -.011.2 for 20-30 km layer, and +.0107 atm/cm/decade for layers above 30 km. Thus, the ozone content decreased in the trophosphere and increased above the 17 mbar level. The total ozone content showed an estimated trend of -3.1 + or - 1.1% decade. The trends at and above the 10 mbar level may have been due to processes affecting ozone photochemistry. Trends below the 17 mbar level may have been due to changes in circulation. The various explanations for the trends are discussed.

41941 **APTIC NO. 65780**

Richter, Juergen H., Douglas R. Jensen, V. Ray Noonkester, Thomas G. Konrad, Abraham Arnold, and John R. Rowland

CLEAR AIR CONVECTION: A CLOSE LOOK AT ITS EVOLUTION AND STRUCTURE. *Geophys. Res. Lett., 11(4):173-176, Aug. 1974. 8 refs.*

The detailed evolution and structure of clear air convection was investigated using advanced remote and direct sensing techniques. Convection produces vertical transport of heat, moisture, momentum, and pollutants. This vertical transfer is important for visibility, cloud, turbulence, pollution, and radiometeorology considerations. The transfer is important for significant energy flux, rain patterns, and atmospheric transmissivity. Measurements were performed at Wallops Island, Va. and involved a high power, narrow beam pulse radar, a frequency modulated, continuous wave radar, an acoustic echo sounder, and instrumented aircraft. The various probing methods complement each other and give a compatible and comprehensive description of the spatial and temporal evolution of clear air convection. (Author abstract modified)

41942 **APTIC NO. 64133**

Schlesinger, William H.

TRACE METAL POLLUTION ARE WE MERELY INCREASING RATES OF NATURAL GEOCHEMICAL CYCLES? *Explorer, 15(4):19-21, Winter 1974. 6 refs.*

The effect of man s activities on trace metal pollution in natural ecosystems is discussed. There is increased deposition of trace elements to remote ecosystems. Outside urban regions, high concentrations of sulfur dioxide in the atmosphere have stunted tree growth. Downwind from a zinc smelting plant in Pennsylvania, the deposition of cadmium and zinc from the atmosphere was responsible for the lack of forest regrowth on forest fire areas. Remote natural areas far removed from downwind from major population and industrial centers receive elevated exposure to and deposition of various airborne pollutants. A forest ecosystem in New Hampshire receives more than 19.6 mg of Pb/sq m annually compared to 1.6 mg for a similar area and time on a mountainside in California. A cumulative increase in Pb deposition correlates with west-to-east air movement across the United States. The excess Pb is undoubtedly due to leaded gasoline and its increased deposition represents an increase in the amount received from natural hydrogeochemical cycling processes. Copper does not increase in concentration, which suggests that normal and essential trace constituents are regulated at stable levels in mammals, but non-essentials such as Pb accumulate because the organisms are now exposed to concentrations in the environment that exceed their normal physiological regulation capacity.

41943 **APTIC NO. 66045**

Seiler, Wolfgang

THE CYCLE OF ATMOSPHERIC CO. *Tellus (Uppsala), 26(1-2): 116-135, 1974. 63 refs.*

The distribution and sources and sinks of carbon monoxide in the troposphere are discussed. The average tropospheric CO mixing ratios differ between the two hemispheres with 0.15 ppm in the northern and 0.06 ppm in the southern hemisphere. There are fluctuations in the northern hemisphere, while the southern remains constant. The total CO production in the troposphere is approximately 10 times 10 to the 14th power g/hr, corresponding to a residence time of 0.5 yr. Carbon monoxide is removed by microbiological processes at the soil surface and by hydroxyl destruction. A smaller part is transported to eddy diffusion into the stratosphere where CO is oxidized by OH. (Author summary modified)

41944 **APTIC NO. 66034**

Swinnerton, J. W. and R. A. Lamontagne

CARBON MONOXIDE IN THE SOUTH PACIFIC OCEAN. *Tellus (Uppsala), 26(1-2):136-142, 1974. 12 refs. (Presented at the International Symposium on Atmospheric Trace Gases, Mainz, Germany, April 2-5, 1973.)*

Carbon monoxide was measured in the marine atmosphere and water in the south Pacific Ocean and the ice-covered Ross Sea to determine the role that the oceans play in the geochemical cycle of CO. Atmospheric CO concentrations are lower in the southern hemisphere (0.04 ppm) than those measured in the northern hemisphere (0.13 ppm). The concentration decreases abruptly when crossing the intertropical convergence zone (ITC) from the north to the south. Surface samples of sea water collected in the south Pacific are supersaturated in CO relative to the overlying atmosphere. The south Pacific Ocean could be a source of CO rather than a sink. Vertical profiles show that CO concentrations in sea water decrease with depth.

41945 **APTIC NO. 64345**

Todomatsu, Takeo

STRATOSPHERIC AERONOMY. *(Seisoken eronomi ni tsuite). Text in Japanese. Taiki Denki Kenkyu (Proc. Soc. Atmos. Electr. Jap.), no. 11:74-79, Jan. 1974. 7 refs.*

The most important photochemical phenomena in the stratosphere are dissociation of oxygen molecules by ultraviolet irradiation and ozone formation. The Chapman classical theory on O3 formation gives a theoretical value about three times higher than the measured value of 3 mm/atm (STP). The major reaction considered for the modification of the theory is the reaction between O3 and nitric oxide producing nitrous oxide, which in turn reacts with O2 reproducing NO. No natural source of nitrogen oxides in the stratosphere is known at present, and 200 ppbv of nitrogen dioxide and 1-10 ppbv of NO found in the stratosphere are transported from other atmospheric regions. The NOx contained in the troposphere from natural and man-made sources are transported to the stratosphere by turbulent diffusion. The NO in the ionosphere is produced mainly by reactions between O2 and excited nitrogen atoms formed by the photoelectric dissociation of N2. The NO concentration measured at the lower ionosphere was 10 ppmv, and was transported downward as NO or NO2. The emission from 500 Concord SST in the ozonosphere will be comparable to the total NOx transported from troposphere and ionosphere. If the photochemical reaction theory between O3 and NOx is valid, the destruction of ozonosphere by SST will be a grave future problem. The dissipation mechanism of NOx from the stratosphere is not clearly known at present.

APTIC NO. 65803

41946

Wanta, R. C.

OZONE ANTAGONIST IN THE AMBIENT AIR OF NORTHWESTERN METROPOLITAN WASHINGTON? *Atmos. Environ., 8(7):687-691, July 1974. 8 refs.*

Causes of nocturnal decreases in ozone levels inside animal chambers were investigated. The decreases occur despite O3 generation at constant rate when the dilution air comes from the outdoors. These decreases last several hours and are associated with a particular meteorological syndrome, characterized by a weakening of the nocturnal radiation inversion with the passage of a ridge. Candidate O3 antagonists include nitric oxide and olefin hydrocarbons such as ethylene. Sulfur dioxide is contraindicated because the bays occur with chromic acid filters on the meter intake, though this exclusion may not be absolute. An ambient concentration of NO averaging 0.30 ppm is capable of producing the bays. Sources of the contaminated air should be expected to occupy volumes of air 50 m or more above ground, often but not always in the western quadrant. The sporadic presence of a rapidly reacting O3 antagonist in the ambient air on the fringes of metropolitan Washington is indicated. (Author abstract modified)

APTIC NO. 66039

41947

Whelpdale, D. M. and R. W. Shaw

SULPHUR DIOXIDE REMOVAL BY TURBULENT TRANSFER OVER GRASS, SNOW, AND WATER SURFACES. *Tellus (Uppsala), 26(1-2):196-205, 1974. 16 refs.*

Vertical gradients of sulfur dioxide concentration were measured over grass, snow, and water surfaces to assess the importance of these surfaces as SO2 sinks. The existence of gradients is taken as confirmation of the ability of these surfaces to take up SO2, thus removing it from the air. Gradients of 6, 3, and 1.5 micrograms/cu m/m power/m were typically found over grass, water, and snow surfaces respectively. The turbulent transfer of SO2 to the interface is discussed in relation to stability of the lower atmosphere and physical and chemical properties of the surfaces. (Author abstract modified)

APTIC NO. 63866

41948

Japan Environmental Agency, Air Quality Bureau

A SUMMARY OF THE 1973 SURVEY OF AIR POLLUTION BY PHOTOCHEMICAL REACTIONS. *(Showa 48-nendo kokagaku hanno ni yoru taiki osen chosa kekka no gaiyo). Text in Japanese. 29p., May 1974.*

The Japan Environmental Agency commissioned the Tokyo Metropolitan Government, Kanagawa, Chiba, and Saitama prefectures in the Tokyo Bay area, and Osaka, Kyoto, Hyogo, Wakayama, and Kagawa prefectures for the Osaka Bay area to investigate pollution conditions in these two large areas during the summer of 1973. The data was analyzed by the Photochemical Reaction Air Pollution Investigation Committee of The Bureau of Air Quality. The results of the air quality investigation and mobile smog chamber experiments are presented. The topics of discussion include: weather conditions; local distribution of oxidants; pollutant concentration distribution by altitude; the transformation of primary pollutants and the formation of secondary pollutants (nitrogen oxides, non-methane hydrocarbons, the relationship between sulfur dioxide and ozone, aldehydes, PAN, ozone formation time, HC photochemical reactions), pollution backgrounds; atmospheric stability; daily fluctuation of ventilation, transport, and dispersion of pollutants over large cities; and air mass movements. One of the characteristics of the 1973 photochemical episodes was a long-term series of oxidant alerts covering large areas under the typical summer air pressure. On 13 occasions, oxidant warnings were simultaneously issued in eight prefectures. On all but one day, the atmosphere was stable, the weather was sunny, and weak winds prevailed. The total high concentration sustaining time in Tokyo Bay was twice as long as that of Osaka Bay, and the locations were always in the pathway or gathering place for air currents. An important calculation method for the local ventilation quantity for box models was developed.

APTIC NO. 65883

41949

STUDENT RAIN SURVEY RESULTS ARE IN. *Curr. Sci., 59(14):1-5, Jan. 9, 1974.*

The effect of air pollution on rain was studied when nearly 16,000 students from more than 1100 schools participated in a national study of rain acidity. The students used hydrion paper to measure the pH of samples of rainwater. The results were sent to the National Oceanic and Atmospheric Administration where they were correlated and mapped by a computer. Large areas in the eastern United States had acid rain. A large patch with a pH of less than 5 was found spreading across the northern states and much of the midwestern states of Michigan, Indiana, Illinois, and Ohio. Smaller acid rain areas were found in the southern and central parts of the U. S. Urban areas such as Chicago, Philadelphia, New York, and Boston had pH values of less than 4. Los Angeles was the only area west of the Mississippi with pH less than 4. Acid rain occurred widely in rural areas; pH measurements of less than 5 were common in lightly populated areas in the northwest. Acid rain may affect plant and animal life, lower the pH of river and lake water, damage buildings and statues, and affect persons with respiratory disease.

1973

APTIC NO. 63973

41950

Akatsuka, Seki

PHOTOCHEMICAL SMOGS IN YOKKAICHI. *(Yokkaichi no kokagaku sumoggu ni tsuite). Text in Japanese. Tokyo Kanku Chiho Kisho Kenkyukai- shi (Geophys. Notes Tokyo Dist. Meteorol. Obs.), no. 6:29?, 1973.*

The photochemical smogs in Yokkaichi are caused by the pollutants from the large petroleum industrial complex (centering around the thermal power plants) along the shoreline of the Yokkaichi harbor, and by the topographical characteristics (a bay in the east and a mountain range in the west), which make the changes of land and sea breezes frequent. In Yokkaichi, petroleum combustion gases are the main cause of photochemical smogs. The gases are pushed to the sea during the night by the land breeze and are carried back to the land by the sea breeze during the day; with the rise of the temperature during the day, the pollutants are transformed into secondary pollutants, irradiated by the sun and heat. About 85% of photochemical smogs occur on days of mobile high pressure, or stable Pacific high pressure, or in the back of high pressure. Generally, in this area, smogs tend to form when an inversion or a weak breeze belt exist in the lower atmosphere, the wind is less than 4 m/sec, and the 9 am wind is easterly or southerly and less than 3 m/sec, and humidity at 9 am is 55-75%.

41951 **APTIC NO. 65823**

Averkiev, M. S. and T. V. Evnevich

THE DETERMINATION OF AEROSOL AND MOIST TURBIDITY OF THE REAL ATMOSPHERE. *(Opredeleniye aerozol noy i vlazhnoy mutnosti real noy atmosfery). Text in Russian. Meteorol. i Gidrol., no. 12:53-58, 1973. 6 refs.*

The results of calculating the absorption of solar radiation by water vapor from S. I. Sivkov s formula are presented, taking into consideration that the radiation absorption by water vapor is influenced by the aerosol turbidity. Based on these data and values of solar radiation in dry but turbid atmosphere at m equals 2 according to Sivkov s formula, a table of solar radiation intensity values in the real atmosphere is calculated and an isopleth graph is constructed which makes it possible to define the characteristics of aerosol and moist turbidity of the atmosphere. The aerosol-induced atmospheric turbidity can be determined by Angstrom s method, or by means of monochromator, interference filters, or cutting filters in a narrow spectral range.

41952 **APTIC NO. 65857**

Blanchet, J., P. Pacarrere, M. Mique, and R. duVachat

TURBULENT DIFFUSION OF A PASSIVE POLLUTANT IN THE ATMOSPHERE. *(Diffusion turbelente d un polluant passif dans atmosphere). Text in French. Meteorologie, no. 27:37-57, July-Sept. 1973.*

The turbulent diffusion and advection by the mean wind of a pollutant in the atmospheric boundary layer were investigated based on the statistical theory of turbulent flows. The equations governing the evolution of the pollutant s parameters were obtained by the same method used to derive those of the air, together with the passivity hypothesis and a closure approximation on second order moments. Numerical simulations of the air pollutan system were made. Simulations were made in the case of the diurnal evolution of horizontally homogeneous atmospheric boundary layers with or without the vanishing mean wind: an inversion layer strongly inhibits the vertical diffusion of the pollutant; the pollutant reaches an almost uniform distribution within adiabatic and turbulent layers; the mean wind hampers the formation of high pollution levels; and at night the pollutant is concentrated in regions of small horizontal and vertical extension around its source.

41953 **APTIC NO. 63452**

Bryson, Reid A.

CLIMATIC MODIFICATION BY AIR POLLUTION, II: THE SAHELIAN EFFECT. *Wisconsin Univ., Madison, Inst. for Environmental Studies, National Science Foundation/Research Applied to National Needs Grant GI-29731, Rept. 9, 14p., Aug. 1973. 12 refs.*

The Sahelian area extending along the southern edge of the Sahara is now in its fifth year of drought. Many other areas of the world are also facing drought, especially areas expecting monsoon rains. The monsoon rains of the Sahelian zone come in the summer, when they come, in common with most regions just south of the subtropical rains. During the monsoon, moist air from the equatorial seas enter the continents, replacing the dry, subsident air of the subtropical anticyclones. This occurs when the anticyclones move poleward in summer. The change in the moisture content of the air occurs at the edge of the moist monsoon airstream, the intertropical discontinuity (ITD). The latitude of the ITD in West Africa is related to the latitude of the subtropical anticyclone. Monsoon rains are affected by the hemispheric wind patterns and the Z criterion. It now seems that atmospheric pollution by carbon dioxide and suspended particulate matter may have affected by vertical temperature gradient by causing a greenhouse effect and increased turbidity, respectively. Increased turbidity effects would be greatest at the poles. Increased turbidity may have decreased sunlight in the Arctic, giving decreased temperatures in the Arctic of 0.5 C, giving an increased equator-to-pole temperature gradient of 0.1 C/1000 km, which in turn would lower the latitude of the subtropical highs and deserts by somewhat over 1/2 a degree and decrease the northern Nigerian rainfall by 10-14 in. The CO2 greenhouse effect may have increased the earth s temperature. If the effect is assumed to be nil at a height of 3 km, then the latitude of the subtropical highs should have moved equatorward by about 15 km and the northern Nigerian rains decreased by 3 in. or so. Thus, both CO2 and particulate may both be acting to suppress the monsoons of the world. Since increased volcanoes may be expected to increase particulate concentrations in the air and since increased human activity will probably increase CO2 and particulate matter further, the likelihood of the monsoons returning is not great.

41954 **APTIC NO. 64161**

Cahill, Thomas A. and Patrick J. Feeney

CONTRIBUTION OF FREEWAY TRAFFIC TO AIRBORNE PARTICULATE MATTER (FINAL REPORT). *California Univ., Davis, Crocker Nuclear Lab., California Air Resources Board Contract ARB-502, Rept. UCD-CNL 169, 122p., June 15, 1973.*

Particulate matter, both liquid and solid, was collected both upwind and downwind of four sites along Southern California freeways in order to investigate the origins and dispersal of particulate matter associated with heavy vehicular traffic. Samples were collected during 9 days between Feb. and Aug. 1972 and about 3000 samples were analyzed for content of elements heavier than sodium by ion excited X-ray emission. Precise, quantitative determinations of all sources of particulate matter from vehicular traffic cannot be made, but the observed particulate matter can be fitted reasonably well by estimated use of automotive expendables. Combustion products of gasoline, including lead, bromine, chlorine, and sulfur, provided about 2/3 of all elements heavier than Na observed to the particulate matter. About 60% of the elements heavier than Na that were seen in particulates consisted of particles less than 5 micron. Combustion products dominated this latter class, with most mass occurring below 0.5 micron. The disperison of particulates was dominated by wind conditions with high values of particulate mass per vehicle occurring in calm periods in near freeway locations. Freeway configurations played a striking role in particulate dispersal in moderate wind conditions. Lead levels at 330 ft downwind of the median of a fill section freeway averaged about 10 micrograms/cu m during a 24 hr period in August. Lead levels from the at-grade freeway section can be predicted to high precision. (Author summary modifed)

41955 **APTIC NO. 61066**

Dana, M. Terry, J. M. Hales, W. G. N. Slinn, and M. A. Wolf

NATURAL PRECIPITATION WASHOUT OF SULFUR COMPOUNDS FROM PLUMES (FINAL REPORT). *Battelle Pacific Northwest Labs., Richland, Wash., Atmospheric Sciences Dept., Environmental Protection Agency Interagency Agreement IAG-025 (D), Program Element 1A1009, Proj. BNW 389/B46621, Rept. EPA-R3-73-047, 215p., June 1973. 33 refs.*

NTIS: PB 232445/AS

Field measurements of precipitation washout were conducted in conjunction with both controlled test sources and actual steam power plant plumes, and a sulfur dioxide washout model which predicts rain-borne SO2 concentrations was formulated. Predictions of the computer-code model compared favorably with washout measurements made during the field experiments. Sulfate washout measurements were also made during the power plant study, and an approximate reaction-washout analysis indicated that a rapid initial oxidation occurs which slows at increasing downwind distance. The sulfate washout coefficient appeared to be about 0.05/hr for background pH equal to or greater than 5.2, but could be much smaller for more acid rains. (Author abstract modified)

41956 **APTIC NO. 63974**

Endo, Yonekichi

DAYS WITH HIGH CONCENTRATION OXIDANTS IN NAGOYA. *(Nagoya no okishidanto kondo bi ni tsuite). Text in Japanese. Tokyo Kanku Chiho Kisho Kenkyukai-shi (Geophys. Notes Tokyo Dist. Meteorol. Obs.), no. 6:294-295, 1973.*

The meteorological characteristics of the days of high oxidant concentrations in Nagoya between June and September 1972 were studied. Those measurements taken at five locations in Nagoya which were more than 0.100 ppm with a maximum of 0.15 ppm or more were considered days of high concentrations, and the oxidant maximum, the average wind velocity, the maximum wind velocity and wind direction, the maximum temperature, the amount of sunshine, and visibility were examined. On the days of high concentration, weak northerly wind blew in the morning and changed to southerly around noon, and one or two hours later, the peak of high concentration tended to appear. The rise of temperature and oxidant concentration almost paralleled, and the peak of concentration tended to appear slightly earlier than the maximum temperature of the day. The duration of the sunshine and the concentration increase had a close relationship, and the oxidant peak seemed to appear after 2-6 hours of sunshine. The visibility decreases while concentration increases, and with the decrease of concentration, visibility improves. The weather maps of the days of high oxidant concentration are presented.

41957 **APTIC NO. 63769**

Primescu, M., N. Romanof, and I. Moroianu

METEOROLOGICAL ASPECTS OF AIR POLLUTION IN AN INDUSTRIAL AREA WITH COMPLEX RELIEF. *(Meteorologische Aspekte der Luftverunreinigung in einer Industriezone mit komplexem Relief). Text in German. Idojaras (Budapest), 77(5):284-289, 1973. 2 refs.*

A method for the study of the effects of meteorological factors on the diffusion and dilution of air pollutants in an industrial zone with complex relief is described. In the industrial area in question, sulfur dioxide emissions from a metallurgical plant, a thermal power plant, and a railroad station were systematically monitored, and isoconcentration lines were obtained from yearly mean SO2 concentration measurements conducted for 2 yr. The effects of different meteorological factors on dispersion processes were studied by simultaneous measurements of wind speed and wind direction up to 2500 m altitude, atmospheric stability, and vertical currents. A mathematical model was developed for the study of the territorial distribution of air pollution. Good agreement between the experimental and theoretical data was achieved.

41958 **APTIC NO. 64013**

Goddard, A. J. H., R. E. Holmes, and H. Apsimon

COMPUTATION AND MAPPING OF THE DISPERSION AND HERBAGE UPTAKE OF GASEOUS EFFLUENTS FROM INDUSTRIAL PLANTS. *Society of Engineering Science, Pollut. Eng. Sci. Solutions, Proc. Int. Meet. Soc. Eng. Sci., 1st, Tel Aviv, Israel, 1972, p. 548-563, 1973. 16 refs. (June 12-17.)*

Computer routines which enable rapid computation of air contamination downwind from complex release patterns are described. Routines exist whereby isopleths of ground level air concentration averaged over varying time intervals are automatically plotted for rapid appraisal. In addition, integrated air concentrations can be predicted for specified locations, such as air sampling stations, and these results printed out. Further routines compute the levels of contamination within plant and animal species as a function of time during the exposure. As an example of the application of some of the routines, the release of fluorides from aluminum smelting is discussed. The significance of aluminum smelting in the United Kingdom and emissions from the notional smelter are described. The relative significance of air and pasture contamination with fluorides, human and animal toxicity, and plant toxicity are reviewed. Calculation of dispersion, computer mapping of concentrations of fluoride at ground level, and calculation of time-dependent herbage levels are discussed for the example of fluorides released from an aluminum notional smelter. The numerical results illustrate the application of this ecosystem pollution program to the initial analytical stages of this type of environmental study. The program provides rapid and readily comprehensible predictions of air and herbage contamination. By virtue of the low cost of operation, computations can be made to relate herbage monitoring and district air sampling results to specific variables such as significant changes in weather, seasonal changes in herbage growth rates, and changes in the release pattern of fluorides from the plant.

41959 **APTIC NO. 63432**

Green, H. S.

POLLUTION BY DIFFUSIVE PROCESSES. *In: Pollution: Engineering and Scientific Solutions. Euval S. Barrekette (ed.), New York, Plenum, 1973 (?), p. 510-521. 8 refs.*

The distribution of a pollutant within its medium and along the boundaries of the medium was determined. The propagation of the pollutant is the combined effect of threy natural processes: transport by currents in the fluid, diffusion by macroscopic processes of a stochastic character, and molecular diffusion. The stochastic theory and the elementary theory of diffusion are sufficiently well developed to allow prediction of the distribution at any time of a pollutant from a known source and the determination of the source or sources of pollution from its observed distribution. Examples of the qualitative and quantative results already available for systems with simple geometries are given and the principles used in these analyses are detailed.

41960 **APTIC NO. 65944**

Holdgate, M. W. and L. E. Reed

THE FATE OF POLLUTANTS. *Inst. of Fuel, London (England), Fuel Environ. Proc. Conf., Eastbourne, England, 1973, p. 113-122. 36 refs. (Nov. 26-29, Paper 8.)*

Sources and sinks of various air pollutants, including sulfur dioxide, sulfates, hydrogen sulfide, carbon monoxide, carbon dioxide, heavy metals such as lead and mercury, nitrogen oxides, hydrocarbons, and photochemical oxidants such as ozone are reviewed from diffusion model and air quality data collected in the United States and Great Britain. A study of major air pollutants and their sources in the United States during the year 1968 indicates that fuel combustion in stationary sources contributed most of the SOx and a substantial proportion of the particulates and NOx; while motor vehicles were in the main source of hydrocarbons and CO. Carbon dioxide is the only pollutant known thus far which is accumulating in the atmosphere in a way which may have a global effect, leading to atmospheric warming. Nitrogen oxides, hydrocarbons, and sulfur dioxide exemplify pollutants whose interactions in the air can produce other substances with more serious effects than the original substances, while lead is an example of the type of pollutant which is dispersed widely in the air, settling out to swell background levels in the soil and oceans. Carbon monoxide does not persist for long in the environment and causes concern only where its local concentrations build up to high levels.

41961 **APTIC NO. 65008**

Hotchkiss, R. S. and F. H. Harlow

AIR POLLUTION TRANSPORT IN STREET CANYONS (FINAL REPORT). California Univ., Los Alamos, N. Mex., Los Alamos Scientific Lab., Environmental Protection Agency Interagency Agreement EPA-IAG-0122(D), Program Element 1A1009, Rept. EPA-R4-73-029, 113p., June 1973. 11 refs.

NTIS: PB-233252/AS

Results of a study to determine the applicability of numerically modeling the transport of pollution in street canyons are presented. The numerical model employs the solutions of the fully nonlinear, three-dimensional Navier-Stokes equations along with a transport equation for pollutants in regions where obstacles or buildings cause strong distortions in the flow fields. The numerical model is used in the formulation of a two-dimensional street canyon, three-dimensional flows for which some experimental data are obtained, including the calculation of pollution distribution in the Broadway Street canyon of downtown St. Louis, and in the calculation of pollutant distributions in a non-specific street canyon. Calculation of the non-specific street canyon gives rise to solutions that are applicable, in a general sense, to a variety of street canyons. (Author abstract modified)

41962 **APTIC NO. 63818**

Ishiguro, Ichiro and Toshio Kawado

THE RELATIONSHIP BETWEEN THE SULFUR DIOXIDE CONCENTRATION IN THE AIR ON THE ROOF OF KINKI UNIV. BUILDING NO. 33 AND THE WIND VELOCITY BY DIRECTION. *(Kinki Daigaku 33-go kan okujo ni okeru taikichu no aryusan gasu nodo to fukobetsu gaiki fusoku to no kankei ni tsuite). Text in Japanese. Kinki Daigaku Kogai Kenkyusho Kenkyu Hokoku (Kinki Univ. Pollut. Res. Inst. Rep.), no. 1:143-150, June 1973.*

The relationship between sulfur dioxide concentration and wind velocity at 8 wind directions was studied. The SO2 concentration was measured by the electroconductmetric method using an automatic recorder. Wind velocity at 8 wind directions was measured from November 1, 1972 to November 30, 1972 on the roof of Kinki University building. The relationship between SO2 concentration and l/wind velocity for 8 directions was obtained by taking random numbers between 00 and 99. Values obtained and frequency of occurrence for each wind direction are given in tabular form. The regression lines for SO2 concentration and l/wind velocity and correlation coefficients were obtained for 8 wind directions. A positive correlation was found in N and NE directions, and the SO2 concentration decreased with the increase in wind velocity. In the case of W and NW directions, no definite correlation was found.

41963 **APTIC NO. 64129**

Iverach, David

THE CALCULATION OF STACK HEIGHTS. *Aust. Chem. Eng., 1973:11-18, May 1973. 15 refs.*

The ground-level concentration of a pollutant determines whether that pollutant is a danger to health or vegetation. Tall stacks may help reduce ground-level concentration by allowing the effluent to be dispersed; but tall stacks do not reduce the mass of pollutants emitted into the atmosphere, and therefore should only be used as a last resort to achieve acceptable ground level concentrations. Since there appears little chance that economic techniques for sulfur dioxide removal will be developed in the near future, tall stacks will continue to be used to reduce SO2. Sulfur dioxide is a particularly important pollutant, because it can increase the daily death rate, accentuate symptoms, cause increased frequency and severity of respiratory diseases, cause increased bronchitis and lung cancer, reduce visibility, cause increased corrosion, and cause chronic plant injury and excessive leaf drop. The effective stack height to decrease ground-level pollution to a certain level can be calculated by a diffusion equation. Equations for calculating plume rise, gas concentration, a single stack height, multiple source stack heights, and approximate solutions are discussed. The heights of smaller stacks can be calculated using the Murphy regression equation, while the Bosanquet-Sutton procedure can be used for large installations.

41964 **APTIC NO. 63835**

Kalpasanov, J. and G. Kurtschatowa

STATISTICAL INVESTIGATION OF THE INFLUENCE OF CERTAIN METEOROLOGICAL FACTORS ON THE DEGREE OF AIR POLLUTION. *(Statistische Untersuchung der Rolle einiger meteorologischen Faktoren fuer den Grad der Luftverunreinigung). Text in German. Idojaras (Budapest), vol. 77:161-164, 1973. 18 refs.*

Statistical correlations between such meteorological parameters as air temperature, relative humidity, wind speed, and the degree of air pollution in urban air in a large industrial area with lead, dust, phenol, cyanide, and sulfur dioxide emissions were studied. Correlation factors ranging from 0.1 to 0.3 were found between temperature and lead concentrations; temperature and SO2 concentration; relative humidity and lead concentration; relative humidity and dust concentration; relative humidity and SO2 concentration; wind velocity and dust concentration, and wind velocity and phenol concentration.

41965 **APTIC NO. 63986**

Kido, Tomoo and Yoshiteru Marumo

THE CHANGE WITH TIME OF THE CONCENTRATION OF ATMOSPHERIC POLLUTION SUBSTANCES. THE RELATION BETWEEN THE CONCENTRATION AND THE TRAFFIC CHARACTERISTICS. *(Taiki osen busshitsu nodo no keijiteki henka. Kotsu tokusei tono kanren ni tsuite). Text in Japanese. Kagaku keisatsu Kenkysho Hokoku, Kotsu-hen (Rep. Natl. Res. Inst. Police Sci. Res. Traffic Saf. Regul.), 14(1):70-77, March 1973. 5 refs.*

No definite pattern is found in the concentrations of carbon monoxide and nitrogen dioxide throughout a year. However, the concentrations of nitric oxide and sulfur dioxide are low between spring and summer, and are high in autumn and winter. The traffic in the Tokyo Metropolitan area is high in Nov. and Dec. and low in Jan. and Aug. Therefore, no correlation was found between the concentration and the traffic. Also no correlations were found in the weekly and daily changes of pollutants and traffic. The concentrations of various pollutants are largely affected by atmospheric conditions such as temperature, wind velocity, and the direction of wind. Analysis of the correlation was made by measuring the amount of traffic the wind velocity in the direction perpendicular to a road, and the carbon monoxide concentration. The correlation factor was 0.62-0.81. This value shows that the concentration of pollutants is largely dependent upon the wind velocity. Examination of diffusion of pollutants stances indicated that diffusion plays only a minor role in the distribution of concentration of polluting substances.

41966 **APTIC NO. 66027**

Kiese, O.

THE CHANGES OF THE ENVIRONMENT BY THERMAL POLLUTION. *(Die Veraenderung der Umwelt durch thermische Belastung). Text in German. Umwelt Aktuel., (6):5-16, 1973. 6 refs. (Presented at the conference held during Environment 72, Stuttgart, Germany, June 30-July 9, 1972.)*

General problems of thermal pollution are discussed. Changes in climate may occur due to the increase in the particulate matter concentration in the trophosphere or of water vapor in the stratosphere with a change of the atmospheric transmittance of short-wave radiation as a result. On the other hand, the increase in the carbon monoxide and water vapor concentration causes practically no increase in the absorption of the radiation emitted from the earth s surface. While the artificial energy input in the energy budget of the earth amounts to only 0.004% of the solar constant, climatic changes due to such artificial energy cannot be excluded due to the concentration of the energy emission sources and their expansion. Power plants and punctiform sources of energy emission emit either warm water into rivers or warm air with high water vapor content which often results in fog and cloud formation.

41967 APTIC NO. 64047

Knutson, Earl O.

SCAVENGING STUDY OF SNOW AND ICE CRYSTALS (FINAL TECHNICAL REPORT). *IIT Research Inst., Chicago, Ill., Atomic Energy Commission Contract AT(11-1)-578, Proj. Agreement 32, Rept. IITRI-C6105-23, 94p., April 1973. 39 refs.*

NTIS: IITRI-C6105-23

Electrostatic effects in the scavenging of aerosol particles by falling snow and ice crystals were studied in an outdoor experiment. Natural snow and ice crystals were allowed to fall 157.5 cm through a test chamber containing an anthracene aerosol of measured size and concentration. The electrostatic charge of each flake was measured upon chamber entry by an induction type charge sensor. The anthracene aerosol was generated by condensation of vapor upon sodium chloride nuclei. The aerosol concentration was determined frequently by sampling with an impactor or an electrostatic sampler, and counting the deposit with a microscope. The concentration range was 300/cc to 5000/cc. Fifty five flakes were collected and analyzed during the 1972-1973 winter season. The electrostatic charges on the flakes ranged from -3.5 to +1.7 times 10 to the -4th power statcoulombs. The number of anthracene particles caught was 0 to 22. The scavenging efficiencies computed for the individual flakes range from unmeasurable (less than .005%) to about 5%. No correlation with the three Kramer- Johnstone parameters that characterize electrostatic scavenging could be found. All previous project data were pooled to develop an empirical model for snow scavenging, the equation for which is given. (Author abstract modified)

41968 APTIC NO. 64228

Knutson, Earl O.

SCAVENGING STUDY OF SNOW AND ICE CRYSTALS (QUARTERLY REPORT). *IIT Research Inst., Chicago, Ill., Atomic Energy Commission Contract AT(11-1)-578, Proj. Agreement 32, Rept. IITRI-C6105-24, 27p., July 6, 1973. 4 refs.*

NTIS: IITRI-C6105-24

The pooled data from 4 years of experiments on aerosol scavenging by individual snow and ice crystal and by snow flakes have been analyzed in terms of dimensionless variables. The present analysis consists of plots and regressions of log E vs. log I, log (Stk) and Log (Pe), as well as log (EIPe) vs. log (IPE superscript 1/2) and log IPe superscript 1/3). The symbols are E, scavenging efficiency; I, interception parameter; Stk, Stokes number; and, Pe, Peclet number. The various plots and regressions indicate that interception is the primary mechanism of scavenging. The plot of log E vs. log I yields a band of data lying just above the line E equals 3I, which is the theoretical line for interception scavenging by spheres in potential flow. Useful presentations of the data are also achieved by using the Friedlander coordinates, EIPe vs. IPe supercript 1/3 and EIPe vs. IPE superscript 1/2. These dimensionless groups are appropriate for scavenging due to the simultaneous action of diffusion and interception. The first pair pertains to Stokes flow, while the second pertains to potential flow. The approximate expression for interception diffusion scavenging by spheres in potential flow fits the snow scavenging data. (Author abstract modified)

41969 APTIC NO. 64039

Lamb, Donna V., Franklin I. Badgley, and August T. Rossano, Jr.

A CRITICAL REVIEW OF MATHEMATICAL DIFFUSION MODELLING TECHNIQUES FOR PREDICTING AIR QUALITY WITH RELATION TO MOTOR VEHICLE TRANSPORTATION (FINAL REPORT). *Washington Univ., Seattle, Depts. of Atmospheric Sciences and Civil Engineering, Washington State Dept. of Highways Contract 63-1062, 56p., June 1973. 72 refs.*

NTIS: PB-224 656

A literature review to assess the state of the art in air quality modeling was conducted as related to motor vehicle transportation problems. Several private companies and governmental agencies with available models were also contacted as were individuals working in the field. Models which were available for review are described and examined with respect to identifications of latest state of the art characteristics, model applicability, and limitations. In most circumstances on-site parameterization of meteorological, topographical, climatological, and other features is required prior to model application. The more complex the model formulation, the more complex the data parameterization requirements. It is recommended that the simplest model that is applicable be used to do the job. A Gaussian plume model in most cases would be adequate. These models are valid for short times and short downwind distances and are well suited for most highway problems. These models require a minimum of input data and are readily developed for in house use either in computer form or with generalized results presented in graphical form. (Author abstract modified)

41970 APTIC NO. 64221

Lee, Robert Lap-Sun

THEORETICAL STUDIES OF URBAN HEAT ISLAND EFFECTS. *California Univ., San Diego, Dept. of Aeronautical Engineering, Thesis (Ph.D), Ann Arbor, Mich., Univ. Microfilms, Inc., order no. 73-24,504, 1973, 167p. 42 refs.*

Analytical and numerical flow calculations were carried out to estimate vertical temperature profiles over a heated area representing a city. A physical understanding of the temperature structure over cities is important, since observations indicate that the formation of weak elevated inversions will prevent effective pollutant dispersion. Steady, planar, linearized flow is considered in a stable atmosphere with a constant stability and a constant effective eddy diffusivity for heat transfer. Main effects over urban areas are predicted. The theoretical results agree with experimental results. Within the linearized framework, the calculations are extended to include different planar surface temperature distribution, the three-dimensional case of a circular heat island, a two-layer atmosphere having a change in stability altitude, a constant eddy viscosity for the perturbed flow, and the Coriolis force. A time-dependent numerical solution of the nonlinear conservation equations is presented. The special case of a constant eddy diffusivity and constant rural velocity is considered. For a vanishing heat-island surface temperature, the nondimensional temperature profiles approach those of the linearized calculations. Calculations are performed for the case in which both rural wind and eddy diffusivity are prescribed functions of altitude. The computed flow fields are qualitatively similar to the linearized solutions with gravity waves producing sufficient lifting of air parcels that some temperature cross-over occurs. Numerical solutions are obtained for the case in which eddy diffusivity is prescribed to vary both horizontally and vertically over the heat island. When eddy diffusivity varies appreciably in the horizontal direction, gravity waves are suppressed. Even greater temperature cross-over can occur because an increased diffusivity over the heat island center produces a cooling of the temperature peak in the radiation inversion. Numerical calculations are performed for the case in which the eddy diffusivity formula varies with the local stability and wind shear. (Author abstract modified)

41971 **APTIC NO. 65924**

Parungo, Farn P. and Rudolf F. Pueschel

ICE NUCLEATION: ELEMENTAL IDENTIFICATION OF PARTICLES IN SNOW CRYSTALS. *Science, vol. 180:1057-1058, June 8, 1973. 4 refs.*

A scanning field-emission electron microscope combined with an X-ray analyzer can be used to locate the ice nucleus within a three-dimensional image of a snow crystal and to determine the chemical composition of the nucleus. This is used to better understand the effect of nuclei in cloud seeding. This method of analyzing ice crystals can also be used to study many scavenging problems occurring in precipitation. (Author abstract modified)

41972 **APTIC NO. 65879**

Raynor, Gilbert S., Eugene C. Ogden, and Janet V. Hayes

DISPERSION OF POLLENS FROM LOW-LEVEL, CROSSWIND LINE SOURCES. *Agr. Meteorol. (Amsterdam), vol. 11:177-195, 1973. 30 refs.*

Dispersion and deposition of pollens emitted naturally from 80-meter long, crosswind, line sources of living plants and of pollens sprayed from a moving vehicle were studied in a set of 45 experiments. Concentrations were measured by 276 wind-impaction samplers mounted in a square array which included four heights at each of 69 positions. Deposition was measured by greased microscope slides on the ground. Data are presented as functions of distance from the source, pollen type, and release height for decrease in concentration, plume height, mass flux, deposition, and deposition velocity. Results are compared with those from previous point and area source dispersion experiments. Values computed from a multi-point source, Gaussian-plume diffusion model gave reasonably good agreement with the experimental measurements. (Author abstract)

41973 **APTIC NO. 64095**

Rotty, R. M.

GLOBAL PRODUCTION OF CO2 FROM FOSSIL FUELS AND POSSIBLE CHANGES IN THE WORLD S CLIMATE. *Preprint, American Society of Mechanical Engineers, New York and Inst. of Electrical and Electronics Engineers, New York, 12p., 1973. 12 refs. (Presented at the American Society of Mechanical Engineers/Institute of Electrical and Electronics Engineers Joint Power Generation Conference, New Orleans, La., Sept. 16-19, 1973, Paper 73-Pwr-11.)*

The current consumption of fossil fuels is adding carbon dioxide to the atmosphere at rates which will affect the global climate to only a small degree unless the consumption continues for a very long period of time. The rate of increase of demand for energy, and fossil fuel energy in particular, leads to projections of atmospehric CO2 levels which can begin to have noticeable effects on the global climate by the end of this century and substantial effects during the first half of the next century. Carbon dioxide causes little or no absorption of solar radiation heating the earth, but it has pronounced absorption bands in the longer wave terrestrial radiation tending to cool the earth which gives rise to the greenhouse effect. Thus, CO2 in increased quantities could upset the planetary radiation balance and give extensive long-term warming. Solar radiation incidence from 1895 to 1965 is tabulated, mean temperature trends are graphed, factors for calculation of CO2 emissions from fuel combustion are discussed, CO2 emissions from 1960 to 1971 are listed, and annual and cumulative production of CO2 from fossil fuels and cement are shown. Observations at Mauna Loa, Hawaii and other locations indicate that over 50% of the CO2 from fossil fuel combustion remains in the atmosphere. (Author abstract modified)

41974 **APTIC NO. 63834**

Savchenko, A. V. and V. V. Smirnov

STUDY OF THE ELECTRIFICATION KINETICS IN CLOUDS BY PROCESS MODELING IN A LARGE AEROSOL CHAMBER. *(Issledovaniye kinetiki elektrizatsii oblachnoy sredy putem modelirovaniya protsssa v bol shoy aerozol noy kamere). Text in Russian. Inst. Eksp. Meteorol., 38(4):3-27, 1973. 33 refs.*

The electrification kinetics in clouds was studied by qualitative and semiquantitative comparison of calculated and experimental results obtained in a 3200 cu m aerosol chamber at humidity contents ranging from 40 to 98%. The electric conductivity and spectral density of the space charge, and the aerosol ultrastructure were continuously recorded. The formation and dissipation of fogs formed by adiabatic expansion in the aerosol chamber brings about a rearrangement of the electric structure of the medium which also applies to natural conditions. The intensity of the electrification and charge separation processes, observed in a humidity range of 40-45%, is of importance for the study of the electrification kinetics in the initial stages of cloud formation. Data on the polar electric conductivity and the light ion concentrations in the air cannot be regarded as quantitative indicators of the electrical status of the aerosol component during changes in the humidity content.

41975 **APTIC NO. 64018**

Smith, G. Louis

MODELING OF TURBULENT TRANSPORT IN THE SURFACE LAYER. *National Aeronautics and Space Administration, Hampton, Va., Langley Research Center, Work Unit 160-44-63-04, Rept. L-8917, NASA TN D-7306, 34p., Dec. 1973. 15 refs.*

NTIS: N-74-12156

The turbulence equations as written by Donaldson using the method of invariant modeling have been applied to four limiting cases of the surface or constant flux layer of the planetary boundary layer. They are neutrally stable, stable (above influence of surface roughness), nearly neutrally stable, and very stable (free convection). For the neutrally stable case, the equations are shown to admit as a solution the familiar logarithmic profile. Boundary conditions suitable for the surface layer are defined and are simple to apply to rough surfaces. Expressions for the macroscale length are given for each case. The parameters b, relating the microscale to the macroscale, and c, the ratio of macroscale length to height, are computed to fit atmospheric data. Owing to the structural difference between mechanically and thermally produced turbulence, different values are found for b and c for the neutrally stable and unstable cases. The b-value for the stable case agrees very closely with that for the neutrally stable case. (Author abstract modified)

41976 **APTIC NO. 65956**

Tsao, K. C., U. K. Saxena, and S. D. Machol

DISTRIBUTION OF AUTOMOBILE EXHAUST EMISSIONS. *Louisville Univ., Ky., Speed Scientific School, Environ. Eng. Sci. Conf., Proc. 3rd Annu. Meet., Louisville, Ky., 1973, p. 173-194. 7 refs. (March 5-6.)*

Automobile-related exhaust gas dispersion was analyzed as a function of emission source strength, wind velocity, traffic density, vehicle speed, and the car between distance. The effect of climatological variables was reflected by selection of mass diffusivity values. The influence of impervious tall buildings on the gas distribution was examined. The dilution of exhaust gas is governed by the molecular and eddy diffusion of automotive discharge with its atmospheric environment. The mass transfer rate is mostly caused by eddies due to turbulent mixing of air. Mass diffusivity value is strongly affected by local meteorological variables, the area topography, and the velocity of vehicle. The mass diffusivity values and the presence of tall structures have the greatest effect upon concentration profiles. (Author conclusions modified)

41977 **APTIC NO. 64232**

Van der Hoven, I. (ed.)

ATMOSPHERIC TRANSPORT AND DIFFUSION IN THE PLANETARY BOUNDARY LAYER. JULY 1971 - JUNE 1972. *National Oceanic and Atmospheric Administration, Silver Spring, Md., Air Resources Labs., NOAA-TM-ERL-ARL-39, 93p., June 1973. 23 refs.*

NTIS: COM 73 11942

A study of atmospheric transport and diffusion in the planetary boundary layer, micrometerology, diffusion climatology, and the application of this work to the disposal of radioactive waste gases into the atmosphere is reviewed. An extensive observational program was carried out near Oklahoma City to determine the effect of a city on the low-level windfield and transport. Measurements were taken on a tower, from tetroons, and by pilot balloon soundings. In another experiment, mesoscale wind patterns and transport were studied in Haswell, Colorado. To examine the effects of sampling interval on speed and velocity spectra calculated from bivane data, data was studied from a bivane located 4 m above the ground when the wind speed averaged 2.5 m/sec. A computerized model was programmed to calculate simulated accident and annual average atmospheric dilution factors. Input to the program included joint frequency distribution of wind speed and stability classes. The design basis accident model, the average annual model, and plots of data are discussed. Building wake studies showed strong directional wind shear in the vertical. During conditions of stable temperature, lapse rate, and low wind speeds, the winds at the 4-meter level of the tower were often flowing in an almost opposite direction from those at the 61-meter level. The 458 m tower in Oklahoma City was used to see if transport statistics could be determined from surface geostrophic wind data and to determine which elevation above ground would be best to test geostrophic winds. Mesoscale windfield data and long-term trajectories determined from single- and multi-station models were also studied. Long distance transport, diffusion, and plume depletion were measured to 100 km. Diagnostic applications were made of wind speed and component spectra. Requests for the forecasting and weather warning service are discussed.

41978 **APTIC NO. 64315**

Kanagawa Prefectural Environmental Protection Center

A STUDY ON DISTRIBUTION OF POLLUTANTS SUCH AS OXIDANTS, OZONE IN THE AIR. *(Taiki-chu no okishidanto, ozon sonota no osen busshitsu no bunpu ni kansuru ichi kosatsu). Text in Japanese. Kanagawa-ken Taiki Osen Chosa Kenkyu Hokoku (Tech. Rept. Air Pollution Yokohama-Kawasaki Ind. Area), no. 15:42-49, Feb. 1973.*

Investigations were conducted concerning the regional distribution of oxidants in the air over Kanagawa prefecture, connections between oxidants, ozone, nitrogen oxides, and other pollutants, as well as the distribution of ozone in the air and its variation with altitude. As a result of long-term measurement of air pollution in Kanagawa s junior high school, the times at which high concentrations of oxidants occurred were found. Between 12 noon and 4 pm the concentrations of sulfur oxides increased with the substitution of the north wind by a sea breeze in the Tokyo Bay. A simultaneous measurement of oxidants in Zama City Hall and two neighboring spots showed fairly different regional distribution of the concentrations of oxidants even in a localized area, while measurement of oxidants and ozone in Zama City Hall revealed a high correlation between the two pollutants. The coefficient of correlation was 0.98. The amount of ozone included in oxidants was 60-70%. When high concentrations of oxidants occur, in many cases, they are accompanied by a discontinuous line stemming from an alternation between a land breeze and sea breeze. In and around the area in which a discontinuous line occurs, wind velocity weakens. Even though when and where a discontinuous line occurs varies from day to day, it always occurs in the areas extending from the north-western part of the prefecture to Miura Peninsula or from the middle part of the prefecture to Miura Peninsula between about 9 am and 3 pm. The concentration of ozone increases under the influence of an inflowing sea breeze. The distribution of ozone, in terms of altitude, varies daily, but when a sea breeze is strong enough to affect the air at an altitude of more than 1000 meters, a high concentration of ozone is measured in the upper air.

1972

41979 **APTIC NO. 63425**

Foley, H. M. and M. A. Ruderman

STRATOSPHERIC NITRIC OXIDE PRODUCTION FROM PAST NUCLEAR EXPLOSIONS AND ITS RELEVANCE TO PROJECTED SST POLLUTION. *Inst. for Defense Analyses, Arlington, Va., Rept. P-894, 33p., Aug. 1972. 16 refs. NTIS, DDC: AD-751 295*

The formation of nitrogen oxides from nuclear explosion is discussed in a study of stratospheric nitric oxide production. Nuclear explosions in the trophosphere leave behind a large mass of very hot air. The residual fireball, together with its immediate hot surrounding air, rises and cools, mainly by the entrainment of colder air. At temperatures near 2000 K, NO is frozen out. This is qualitatively similar to the origin of abundant NO in the much more rapidly cooling exhaust from an SST engine. The fireball and its subsequently entrained air will penetrate tropopause and ultimately stabilize in the stratosphere when the initial low altitude explosion has a yield of a metagon or more. This is the major source of stratospheric NO injection from nuclear tests. During certain years of intense nuclear testing, high-yield nuclear explosions injected into the stratosphere a few times 10 to the 34th power NO molecules. This is very similar to upper estimates for NO generation from 500 SSTs flying for a year. Large catalytic ozone reduction from such NO injection was not observed.

41980 **APTIC NO. 64267**

Friend, James P.

TRACE MATERIAL COMPOSITION OF THE LOWER STRATOSPHERE. *Dept. of Transportation, Cambridge, Mass., Transportation Systems Center, Proc. Surv. Conf. Clim. Impact Assess. Program, Cambridge, Mass., 1972, p. 71-79. 28 refs. (Feb. 15-16.)*

The chemistry of the trace material composition of the lower stratosphere is reviewed. The natural global distributions of atmospheric methane, carbon monoxide, and oxides of nitrogen are linked together in a photochemical system. Since the oxidation of CH4 is a principal source of CO, natural sources outweigh polluting sources by a factor of about 15. The CO may be removed from the atmosphere largely by reaction with hydroxyl radicals. Soil bacteria may contribute to removal at the earth s surface. The photochemistry of stratospheric O3 is affected by natural background concentrations of nitric oxide and nitrogen dioxide. Transport by general atmospheric circulation, as well as photochemistry, is important in the global distribution of O3. Stratospheric sulfate aerosols may be formed by the gas phase oxidation of sulfur dioxide by oxygen atoms. Much of the SO2 that enters the stratosphere may be of volcanic origin. Estimates of global sources of CH4 are rough. Model calculations based on the oxidation of CH4 by OH attack followed by several other steps agree with the available concentration measurements. (Author abstract modified)

41981 **APTIC NO. 63461**

Mahlman, J. D.

PRELIMINARY RESULTS FROM A THREE-DIMENSIONAL, GENERAL-CIRCULATION/TRACER MODEL. *Dept. of Transportation, Washington, D. C., Dept. Transp. Surv. Conf. Clim. Impact Assess. Program, 2nd, 1972, p. 321-337. 11 refs. (Nov.)*

Some initial results from a three dimensional tracer model which uses time evolving, three dimensional output from the general circulation model described by Mahlman and Manabe are presented. In the tracer integrations, three dimensional advection and horizontal sub-grid-scale diffusion are calculated. Arbitrary parameterizations of sources and sinks can be included. The advective terms and time differencing are formulated so as to suppress artificial numerical damping. Currently, two major experiments are being conducted. The first is a diffuse point source injection into the Northern Hemisphere, mid-latitude winter stratosphere. The other is a vertically stratified tracer with a crudely simulated photochemical equilibrium at the upper level and a precipitation dependent sink at the lowest levels. There are many similarities to the behavior of analogous stratospheric trace substances. The first experiment shows features close to those of radioactive debris from recent Chinese bomb tests. The second experiment exhibits many features common with those of observed ozone. (Author abstract modified)

41982 **APTIC NO. 64038**

Raynor, Gilbert S., Janet V. Hayes, and Eugene C. Ogden

EXPERIMENTAL DATA ON PARTICULATE DISPERSION INTO AND WITHIN A FOREST. PART I: DISPERSION FROM UPWIND POINT SOURCES (INFORMAL REPORT). *Brookhaven National Lab., Upton, N. Y., Meteorology Group, Environmental Protection Agency Research Grant R-800677, 108p., Dec. 1972. 17 refs.*

NTIS: BNL 17750

Dispersion of particles into a forest edge and within the 10 to 13 m tall pine forest was studied in a series of 72 tests. Colored ragweed pollen and a variety of other particulates were used as tracers. Emission points were located from within the forest edge to 60 m upwind and from 1.75 m to 14 m above the ground. Particles were sampled by 119 rotoslide samplers mounted in and above the forest at heights from 0.5 to 21 m on towers and low level supports along seven rows, 10 m apart, extending 100 m into the forest. Deposition on the ground was measured and meteorological data taken during each test. The experimental site, instrumentation and procedures are described. Data presented for each test include concentration normalized by the output rate, plume width and height, mass flux, normalized centerline and crosswind integrated deposition, and deposition velocity. Data are classified by distance and height of the release point and by particle type. Means and standard deviations are given for groups of similar tests. (Author abstract)

41983 **APTIC NO. 65894**

Raynor, Gilbert S., Eugene C. Ogden, and Janet V. Hayes

DISPERSION AND DEPOSITION OF TIMOTHY POLLEN FROM EXPERIMENTAL SOURCES. *Agr. Meteorol. (Amsterdam), vol. 9:347-366, 1971/1972. 22 refs.*

Dispersion and deposition of timothy pollen emitted naturally from circular area sources 18-37 m in diameter and artificially from point sources were studied in 64 tests. Concentrations were measured by wind impaction samplers mounted at four heights (0.5-4.6 m) and five or six distances from the source on 20-degree radii. Deposition was measured by greased microscope slides on the ground. Data were analyzed in terms of current dispersion theory. Normalized centerline concentrations, crosswind integrated concentrations, plume widths and heights, mass flux, and size of areas having concentrations above selected values are presented as functions of distance and are related to source size and meteorological variables. Deposition data are also related to distance and source size. Most deposition velocities ranged from 10 to 14 cm/sec, but many values close to the source were much higher. Loss of airborne particles between sampling circles was compared to deposition over the same distances. Results are compared to previous dispersion and deposition experiments, including a large number of similar ragweed pollen tests, and to theory. (Author abstract)

41984 **APTIC NO. 64158**

Shenfeld, L. and A. E. Boyer

THE UTILIZATION OF AN URBAN AIR POLLUTION MODEL IN AIR MANAGEMENT. *Preprint, American Chemical Society, 36p., July 1972. 8 refs. (Presented at the American Chemical Society, National Meeting, 164th, New York, Aug. 28-Sept. 1, 1972.)*

A multiple-source urban diffusion model was developed for Metropolitan Toronto. An emission inventory was completed for Toronto and Hamilton, Ontario which included sources of sulfur dioxide, nitrogen oxides, particulates, carbon monoxide, and hydrocarbons. A summary of emissions by source and type is given. The input to the diffusion model includes the emission inventory and windfield and other meteorological data. Limiting meteorological conditions which produced peak concentrations were used to simulate meteorological conditions. These are listed and discussed. The model was reliable within a factor of two of the measured values for 70% of the predictions for time periods as short as 1 hr. When the frequency of predicted air concentrations was considered over a period of days, the model was more reliable -- concentrations were within 10% of those measured. The air quality objective was estimated from air quality standards; the specification of the criteria by which present or predicted air quality levels are scored will, in large part, determine the characteristics of the system design. Several applications of the model are discussed including a typical simulation of air quality (sulfur dioxide) in 1975, simulation of carbon monoxide concentrations resulting from automotive emissions, a Toronto district heating study, urban planning, and air quality planning.

41985 **APTIC NO. 63989**

THE RADIATION BALANCE. *In: Patterns and Perspectives in Environmental Science. p. 65-69, 1972.*

GPO

The effect that man's activities have on the atmosphere of the planet, through smoke and fog, and the exhaust of large jet aircraft, is discussed. The development of quantitative studies of the radiative losses to space, and a study of the effect of aerosols and increased carbon dioxide content in the atmosphere are discussed. Radiation is the ultimate source of energy to drive the complex atmosphere-ocean system. The solar radiation that reaches the earth is partly reflected back into space, partly absorbed by the atmosphere, but mostly absorbed by the surface. The average reflectivity is referred to as the earth's albedo. Cloud cover is an important variable. Aerosols play an important role in the radiation balance of the earth, both natural and man-made. Infrared absorbers, including trace gases (water vapor and carbon dioxide being most important in the lower atmosphere) and aerosols of all kinds, including clouds, have a marked effect upon the balance of the earth life-support system. A need for scientific determination of these factors on our climate is cited.

41986 **APTIC NO. 63990**

CLIMATIC CHANGE AND THE EFFECTS OF CIVILIZATION. *In: Patterns and Perspectives in Environmental Science. p. 69-74, 1972.*

GPO

World wide climatic changes are discussed, and possibilities of man's actions in controlling them are presented. Fluctuations in solar intensity, the fraction of incoming solar radiation that is reflected or scattered away before reaching the ground, and the greenhouse effect are the major causes of variation in the mean temperature of the earth. A change in one or two percent in any one of these variables is enough to produce a significant climatic change, yet none of them is known with this accuracy except perhaps the solar intensity. The albedo of the earth atmosphere system can be changed by changes in the transparency of the atmosphere resulting from particulate pollution. The greenhouse effect depends on the water-vapor content of the air, dustiness, cloudiness, and, especially, the carbon dioxide content, and so can be affected by human activity. The population of the earth contributes to the modification of the albedo through the greenhouse effect and shear numbers and control of energy. It is not the mean temperature of the earth that is important, but the circulation pattern of the atmosphere. Major environmental changes have been taking place very rapidly, and it is essential that the many questions that arise from possibilities of major volcanic eruptions, and another glacial age be answered and acted upon by science.

41987 **APTIC NO. 63991**

URBAN EFFECTS ON WEATHER AND CLIMATE. *In: Patterns and Perspectives in Environmental Science. p. 113-120, 1972.*

GPO

The effects of urban life on the weather are classified as beneficial or detrimental depending on the locale and the interests involved. Such changes as increased contaminants, higher warm-season temperatures, lower winds, added fog, increased thunder and hail, added snowfall, and decreased visibility are considered undesirable. Warmer winters and additional rainfall to cleanse the air and to add water in downwind agricultural areas are desirable effects. To study the processes whereby urban conditions affect the weather, a new data base, instrumentation, three-dimensional, mesoscale numerical models, and computers with the capacity to handle them are needed. Weather modification, regional planning, and effect of the weather change on pollution counts, all in keeping with significant economic aspects are practical implications. The influence of urban growth on local and mesoscale weather is seen in the water balance, heat islands, decreases in wind circulation, weakening of solar ultraviolet rays, increased precipitation, and atmospheric stagnation. Local, regional, and global effects of pollution are discussed in terms of increase in turbidity, and possibilities of another ice age.

41988 **APTIC NO. 63992**

PRECIPITATION MODIFICATION. *In: Patterns and Perspectives in Environmental Science. p. 169-179, 1972.*

GPO

Artificial alteration of natural precipitation is discussed. Almost all U. S. efforts to change precipitation through cloud seeding rest on the observation that the normal behavior of a cloud can be altered through the introduction of large numbers of suitable nuclei. Cloud seeding requires elaborate systems for real-time measurement of deterministic meteorological factors, and real-time computer-modeling of the physical processes of the clouds to permit objective decisions as to when, where, and how to seed. A serious difficulty is the general lack of data on the internal microstructure of clouds as a function of cloud type, season, geography, and meteorological situation. Modification of radiation processes is another procedure besides cloud seeding. The increasing of humidity high in the air is also possible. Important factors in determining whether or not a given weather situation is treatable are the number of natural nuclei, temperature structure, wind, liquid water content of the cloud, and cloud-droplet size spectra. The most frequently used materials are silver iodide and dry ice. Others used experimentally are salt, lead iodide, calcium chloride, and a host of organics, including metaldehyde, phloroglucinol, urea, and 1,5-dihydroxynaphthalene. Different methods are needed to deliver the various materials to the cloud, usually from an airplane, but also ground releases which rely on the horizontal and vertical airflow to carry the material to the cloud. Extra-area effects, the significance of cloud-top temperature, and technological improvements are discussed. Implications for society are viewed through potential benefits and liabilities, legal and normative issues.

41989 **APTIC NO. 63995**

AIRBORNE BIOLOGICAL MATERIALS. *In: Patterns and Perspectives in Environmental Science. p. 339-349, 1972.*

GPO

An Aerobiology Program, established within the International Biological Program (IBP), to study biologically significant materials in the atmosphere, such as spores, pollen, fragments of algae and molds, minute insects, and toxic particles and gases, is dedicated to monitoring ecological systems. A systems approach will develop functional models of the multiple-parameter problem of the entire process: particle formation, release, takeoff, aerial trajectory, scavenging or deposition, germination (if viable), and effect on biota or environment, so that prediction is based on all observable parameters with standardized criteria for observations and measurements. There is a need for development of joint probability meteorological statistics connected with the favorable conditions for spore release, quantitative transport, and the optimum infection climate. The aerobiology of plant and animal diseases are discussed. Transmission of bacteria, spores, or viruses in the air causing various animal and human diseases, is most often atmospherically transported over a short distance and with a water droplet or on some other particle. Most of the control work has been directed toward eradicating the infectious agent by chemical sterilization of its natural habitat. Greater uniformity in air sampling and reporting techniques, and better organization and availability of accumulated information of allergenic particles, are necessary for improved prediction of exposure. The aerobiology of outdoor and indoor environments is discussed with suggestions for ventilation and air conditioning. Transport of insects and other very small animals by wind is important because of the inherent potentiality of pest epidemics and vectoring of diseases. Prospects for aerobiology, biological monitoring techniques for measuring aeroallergens, and requirements for scientific study are presented.

41990 **APTIC NO. 63996**

EFFECTS ON THE OCEAN OF ATMOSPHERIC CIRCULATION OF GASES AND PARTICULATE MATTER. *In: Patterns and Perspectives in Environmental Science. p. 357-360, 1972.*

GPO

The introduction by man of materials in the atmosphere, with subsequent impact on the oceans is discussed. Three major responses by the environment to such activities by man include: alteration of its physical nature, alteration of climate, and alteration in the constitution of communities of organisms. The identification of materials from fuel combustion and from industrial production is incomplete. Volatile synthetic organic chemicals are dispersed about the atmosphere and their impacts are still described inadequately. Coal, oils, and natural gas are the greatest sources of man-introduced materials to the environment, increasing the release of carbon dioxide. The transport of solids to the marine environment by atmospheric paths is noted with examples. Removal of solids from the atmosphere takes place through scavenging by precipitation, rain, snow, sleet, and rime and by gravitational settling. The dust accumulation rate has been increasing steadily since 1950. Interaction of contaminants and the atmospheric-ocean system is in need of further clarification, with monitoring of substances man is pouring into the atmosphere.

1971

41991 **APTIC NO. 64271**

Chaudhry, F. H. and J. E. Cermak

WIND-TUNNEL MODELING OF FLOW AND DIFFUSION OVER AN URBAN COMPLEX. *Colorado State*

Univ., Fort Collins, Fluid Dynamics and Diffusion Lab., Office of Naval Research Contract N00014-68-A-0493-001, Proj. NR 062-414/6-6-68(Code 438), Proj. THEMIS, Technical Rept. 17, CER70-71FHC-JEC24, 90p., May 1971. 27 refs.

The powerful potential of wind tunnel modeling was investigated as an alternative to the more expensive and tedious full scale urban diffusion experiments. A model of the city of Fort Wayne was constructed to a horizontal scale of 1:4000 and a vertical scale of 1:2000. Flow and diffusion over the model was studied. If the rougheness and the heat island effects modeled properly, and the approach flows made similar, the flow over the model city was found to conform to that in the field. The pattern of the heat island over Fort Wayne was reproduced almost exactly in the model. Simulation of diffusion from an aerial line source was accomplished by transversing a continuously emitting source of Krypton-85 upwind of the city. The measured dosages of this tracer over the city compare well with the corresponding field data except immediately downwind from the source where the downdraft from the disseminating aircraft becomes significant in the field. The model is found to give the same overall picture of the effect of the city on the dispersion process as that observed in the field. The heat island effect vitiates the environment by bringing pollutants down from elevated releases through enhanced vertical mixing. The model results compare reasonably with approximate theory of Smith (1957). It is possible to simulate the flow over a city and obtain useful information, relatively inexpensively, on urban diffusion. (Author abstract modified)

41992 **APTIC NO. 63570**

Deschwanden, P. von

WEATHER AND MICROBIOLOGY OF THE AIR AT AN ALPINE STATION. *(Wetter und Mikrobiologie der Luft einer Alpenstation). Text in German. Ann. Meteorol., no. 5:283-285, 1971. (Presented at the 11th International Conference on Alpine Meteorology, Oberstdorf, West Germany, Sept. 22-26, 1970.)*

Results of microbiological investigations of air and precipitation samples carried out at a meteorological station in the Swiss Alps at 1360 m above sea level are presented. The yearly variation in the bacteria and mold counts in the air corresponded to the classical pattern established for lowland conditions, but they were lower than in lowland, and higher than in higher mountains. The ratios of the bacteria and mold counts as measured in summer and winter were 1:8 and 1:1, respectively. All summer and winter precipitation samples contained both bacteria and molds. Bacteria and molds occurred relatively frequently in fog, and rainstorms and had the highest washout effect of all forms of precipitation.

41993 **APTIC NO. 63569**

Jost, D.

CARBON DIOXIDE CONCENTRATIONS IN ST. MORITZ AND PIZ CORVATSCH. *(Die Kohlendioxidkonzentration in St. Moritz und am Piz Corvatsch). Text in German. Ann. Meteorol., no. 5:293-295, 1971. (Presented at the 11th International Conference on Alpine Meteorology, Oberstdorf, West Germany, Sept. 22-26, 1970.)*

Results of comparative measurements of the carbon dioxide, sulfur dioxide, ozone, and Aitken nuclei concentrations at St. Moritz and on Piz Corvatsch in Switzerland are presented. Daily variation of the CO2 concentrations, which were highest before sunrise and lowest in the evening, was determined by similar variations in the assimilative activity of the vegetation, and was modified by the turbulent motion of air masses at great height (Piz Corvatsch). The Aitken nuclei concentration increased after sunrise. The O3 concentration started increasing 0.5-1 hr after the decrease of the CO2 concentration. The SO2 concentrations were determined by advective processes.

41994 **APTIC NO. 64123**

Kasina, S.

DISTRIBUTION OF ATMOSPHERIC POLLUTION IN THE PUSZCZA NIEPOLOMICKA REGION. *(Rozklad zanieczyszczen atmosferycznych w rejonie Puszczy Niepolomickiej). Air Conserv. (English translation from Polish of: Ochrona Powietrza), 5(2):10-18, 1971. 18 refs.*

NTIS: TT 72-54022/2

The average monthly concentrations of sulfur dioxide were determined using a contact process with lead oxide, and dust fall was measured with a sedimentation method. According to the thermodynamic conditions of air in a forest, the pollution mainly expanded over the forest. Measurements of the average monthly SO2 concentrations did not permit the determination of the influence of the forest upon air cleaning due to the long periods for single measurements. On the other hand, the considerable impact of forests upon the removal of dust, such as fine iron dust, from the atmosphere, was discovered. This purification is, to a large extent, created by an accelerated coagulation of fine grains of dust over a forest which leads to increased dust fall in the forest. The dust fall was consistent with the distribution of wind directions. The time distribution of dust fall within the year was irregular. Sulfur dioxide concentrations varied vertically and horizontally in the same way over the forest as over an open area. During the winter, SO2 concentrations were two to three times higher than in the summer, because of increased fuel burning to heat buildings.

41995 **APTIC NO. 64124**

Kasina, S.

CONCENTRATION OF IRON IN AIR AS AN INDEX OF POLLUTION DIFFUSION IN THE ATMOSPHERE. *Air Conserv. (English translation from Polish of: Ochrona Powietrza), 5(2):42-49, 1971. 13 refs.*

NTIS: TT 72-54022/2

On the basis of calculations of the quantity of pollutants emitted during metallurgical processes and coal combustion, the concentration of iron in air was adopted as an index of atmospheric pollution in the region of an iron and steelworks, depending on meteorological conditions. Calculations showed the concentration of iron dusts to be virtually independent of the chemical reactions which iron compounds may undergo in the air. Statistically analyzed mean directional concentrations of iron dust indicated that the spreading of pollutants emitted by steel and ironworks can be studied irrespective of pollution emitted by steel and ironworks can be studied irrespective of pollution from other sources. The mean 24-hour iron dust leading of the air was measured in Cracow, Poland. At 15 km from the ironworks, the concentration of iron dust was 1/50th of that in the vicinity of the emission source. The concentrations of iron dust depended on the wind direction to a great extent.

41996 **APTIC NO. 64233**

Oden, Svante

THE EXTENT AND EFFECTS OF ATMOSPHERIC POLLUTION ON SOILS. *In: Effects of Intensive Fertilizer Use on the Human Environment. Swedish International Development Authority and United Nations, Food and Agriculture Organization, Soils Bull. 16. p. 179-194, 1971 (?).*

The effects of air pollution on soils, precipitation, lakes, rivers, and oceans are reviewed. Air pollutant concentrations rapidly changed over the last twenty years; these changes may have great biological effect. The addition of nitrogen in the form of nitrate and ammonia to soils, lakes, and rivers may affect the productivity of these systems. Increased fallout woul/ increase eutrofication. Generally nitrate has increased in precipitation in Europe due to increased burning of fossil fuels, the conversion of N2 to nitrogen oxides by high temperature engines, and increase in the use of nitrogen fertilizers. Sulfur dioxide, sulfuric acid, hydrogen sulfide, and other sulfur emissions can damage plants and affect land, forest soils, lakes, and rivers. Increased sulfur fallout rates over Europe from 1957 to 1963 and increased concentrations of sulfur in precipitation have occurred. Excess acids in precipitation, such as H2SO4, hydrogen chloride, and nitric acid, causes acidification - the pH value decreases. The distribution of the acidity of the annual precipitation in Europe over the year is discussed. The acidity of the air and precipitation causes widespread effects such as increased corrosion, damage to humans and animals, damage to microorganisms and plants, depletion of soil nutrients, and acidification of lakes and rivers. Chlorinated hydrocarbons have also accumulated in soils due to increased pesticide use. Increased soil pollution has also led to increased amounts of pollutants in foods; nitrate concentrations in different foods are listed. Changes in acidity of precipitation in Europe are shown for 1957, 1960, 1962, and 1965.

41997 **APTIC NO. 64234**

Poetzl, K. and R. Sladkovic

PRINCIPAL CHEMICAL COMPONENTS OF AEROSOLS AT 1800 M ABOVE SEA LEVEL AS A FUNCTION OF AIR MASS CHARACTERISTICS AND EXCHANGE. *(Chemische Hauptkomponenten des Aerosols in 1800 m NN in Abhaengigkeit von Luftkoerpereigenschraft und Austausch). Text in German. Ann. Meteorol., no. 5:287-292, 1971. 7 refs. (Presented at the Internationale Tagung fuer Alpine Meteorologie, XI, Oberstdorf, West Germany, Sept. 22-26, 1970.)*

Initial results of an investigation concerning the attachment of typical chemical aerosol composition with defined types of air masses are discussed. Aerosols were sampled on membrane filters during 6 mo at a mountain station that is free from local pollution. Intervals of sampling were selected by meteorological aspects, and, to the extent possible, synchronized to air mass changes. By quantitative trace analysis the following individual elements in the aerosol mass were determined: water-soluble constituents - sodium(+), potassium(+), and calcium(++); and constituents in soluble in water - calcium oxide, ferric oxide, silicon trioxide, and alumina. These were correlated with precipitation rate, effect of temperature, characteristics of air masses, and vertical mass exchange. The results demonstrated that statements of supraregional application are dependent upon the following conditions: measurements at a sufficient altitude above sea level; freedom from local pollution; consideration of all meteorological parameters, particularly vertical mass exchange and seasonal variation; and long-term recordings to secure comprehensive data. Under these conditions, typical aerosol compositions may be correlated with air mass characteristics and fundamental statements concerning kind, extent, and long-term variations in air impurities on a continental scale.

41998 **APTIC NO. 65882**

Turpin, R. A. and R. A. Schlising

A NEW METHOD FOR STUDYING POLLEN DISPERSAL USING IODINE-131. *Radiat. Bot., 11(1):75-78, 1971. 5 refs.*

Pollen and pollen-vector movement was followed in preliminary field trials by labeling pollen with constant amounts of iodine-131 and tracing this labeled material by field collection and laboratory analysis of the iodine-131 present. This technique is applicable not only in tracing pollen dispersion in populations of plants but also in helping identify pollen vectors. It can be used to enhance knowledge of flower pollination or for studying pollen air pollution. (Author abstract modified)

41999 **APTIC NO. 64093**

Waldron, Albert W., Jr.

EXPECTED INSTANTANEOUS SURFACE LINE SOURCE AND POINT SOURCE BEHAVIOR IN A FOREST ENVIRONMENT. *Dept. of Army, Fort Douglas, Utah, Deseret Test Center, RDTE Proj. 1-T-0-62111-A-128, USATECOM Proj. 5-CO-403-000-030, DTC Proj. DTC-TN-72-601, 73p., Aug. 1971. 19 refs.*

NTIS: AD 887032

Research on aerosol diffusion below a forest canopy is reviewed relevant to the expected behavior of point and line sources originating in a forest. A useful method of estimating the effect of a forest on the vertical wind profile for the neutral temperature profile case is discussed. Analysis of the data collected for four diffusion trial series indicated that a large percentage of an aerosol cloud released at the surface within a forest will remain below the canopy. Vertical mixing tended to produce uniform dosages at all heights beneath the canopy within a distance of 1 km from the source. The aerosol cloud movement direction below the canopy was an average of 33 to 78 deg. to the left of the above-canopy wind direction. Individual trial values were widely scattered about this mean, with an estimated standard error of 81 deg. Wind speeds at 1.5 m in a temperate leafed forest varied from 0.05 to 0.5 of the speed above the canopy. During the winter, when the trees were leafless, the 1.5-meter wind speed could be half the above-canopy speed. Aerosol cloud lateral growth rate under the canopy was similar to that of the slightly stable case over open terrain. In the vertical, the cloud growth rate was similar to that of the unstable case over open terrain. (Author abstract modified)

1970

42000 **APTIC NO. 63439**

Dmitrijew, M. T., N. A. Kitrosskij, and T. V. Solowjowa

BASIC HYGIENIC ASPECTS OF AIR POLLUTED BY EXHAUST GASES. *(Grundlegende hygienische Aspekte der durch Abgase verunreinigten Luft). Text in German. Wiss. Z. Humboldt-Univ. Berlin. Math.- Naturw. Reihe, 19(5):529-531, 1970.*

Studies on the composition of automobile exhaust gases and on the chemical interactions in the atmosphere between nitrogen oxides, hydrocarbons, and ozone are reviewed. On an average, exhaust gases contain 76% nitrogen, 10-15% carbon dioxide and carbon monoxide, 4% water, 0.4-0.8% nitrogen oxides and ozone, as well as about 180 different organic compounds of which acetaldehyde, xylene, acrolein, xylenol, cresol, crotone aldehyde, formaldehyde, methylethylketone, acetone, ethylene, acetylene, phenol, benzene, propylene, ethylbenzene, and butylene are the most toxic. At wavelengths of at least 395 nanom, ozone is formed in the presence of nitric oxide and nitrogen dioxide, and this process is further intensified by hydrocarbons present in the atmosphere. Also, hydrocarbons present in the air produce hyperoxides and other oxides by photochemical reactions, which in turn oxidize NO and to produce ozone. The observed decrease in the ozone concentration with increasing distance from the nitrogen oxides and hydrocarbon emission sources in urban areas demonstrates the relationship between ozone formation and such emissions. The atmospheric ozone content decreases with increasing absolute humidity, air temperature, and wind speed.

1969

42001 **APTIC NO. 64285**

Bakulin, V. N., E. E. Senko, B. G. Starikov, and V. A. Trufakin

UTILIZATION OF NATURAL RADIOACTIVE SUBSTANCES IN THE STUDY OF TURBULENT EXCHANGE AND ATMOSPHERIC SCAVENGING BY MEANS OF GROUND MEASUREMENTS. *Main Administration of the Hydrometeorological Service (U.S.S.R.), Inst. of Experimental Meteorology, Proc. All-Union Conf. Nucl. Meteorol., Obninsk, U.S.S.R., 1969, p. 166-172. 14 refs. (June 23-28.) Translated from Russian. Israel Program of Scientific Translations, Jerusalem, 1974.*

NTIS: TT 7450011

On the basis of round-the-clock measurements of the exhalation of thoron and the concentrations of thoron and lead 212(Thb) at heights of 1 and 5 m, mean values were obtained of the growth rate of the turbulence coefficient with height in a summer anticyclone, equal to 5-10 cm/sec by day and about 3 cm/sec at night. The mean value of the turbulence coefficient in the lower km layer of the troposphere can be evaluated with the aid of ground measurements. Unlike thoron and Pb212(Thb), radon cannot be considered as existing in quasi-steady conditions, and nonsteady models of its behavior must be used. Near the earth, the ratio between the decay products of radon is a good indicator of the time variation in the turbulent exchange. Maximum perturbations of equilibrium in the radon series are observed in the morning and evening, during the establishment and destruction of the night inversions. In the morning hours many specific features in the height distribution of radioactive substances are observed, explained by the mechanisms of the inversion destruction process. Data are given about the washout coefficients of radioactive aerosols by precipitation on the basis of Pb212(Thb), radon, and Pb210(RaD) concentration measurements. (Author abstract modified)

42002 **APTIC NO. 64286**

Burtsev, I. I. and L. V. Burtseva

COMPARISON OF THE CHARACTERISTICS OF HYGROSCOPIC AND NONHYGROSCOPIC AEROSOL WASHOUT BY CLOUD-BORNE DROPS. *Main Administration of the Hydrometeorological Service (U.S.S.R.), Inst. of Experimental Meteorology, Proc. All-Union Conf. Nucl. Meteorol., Obninsk, U.S.S.R., 1969, p. 146-153. 11 refs. (June 23-28.) Translated from Russian. Israel Program of Scientific Translations, Jerusalem, 1974.*

NTIS: TT 7450011

Washout by cloud-borne drops of aerosol of size 0.1-0.5 micron is examined as a function of its hygroscopicity. Radioactive hygroscopic phosphoric anhydride and nonhygroscopic stontium carbonate aerosols were investigated and their washout characteristics compared. An experimental comparison of the characteristics of the capture of aerosol of the same disperse group, but with different physical properties, shows that the hygroscopicity of the aerosol substantially affects its behavior in a cloud medium. The capture efficiency of hygroscopic aerosol is twice that of nonhygroscopic aerosol. (Author abstract)

42003 **APTIC NO. 64289**

Guterman, I. G.

MEAN AND TURBULENT TRANSFER OF SUBSTANCES OVER THE USSR. *Main Administration of the Hydrometeorological Service (U.S.S.R.), Inst. of Experimental Meteorology, Proc. All-Union Conf. Nucl. Meterol., Obninsk, U.S.S.R., 1969, p. 42-55. 13 refs. (June 23-28.) Translated from Russian. Israel Program of Scientific Translations, Jerusalem, 1974.*

NTIS: TT 7450011

The relation is examined between the mean and turbulent fluxes of substances at the limit of the atmospheric boundary layer (1.5 km) in January and July over the USSR. The intensity of macroturbulent fluctuations, characterized by the ratio of the vectorial standard deviation of wind (sigma sub v) to the modulus of the resultant wind, is equal to 100-500% in winter and 200-2000% in summer. This results mainly from the decrease in mean transfer, since the macroturbulent component of the motion sigma sub v in summer is of the same order as in winter. Turbulent heat fluxes in January hardly attain 1-3% of the fluxes due to the mean motion, while in July the ratio increases to 4-7%. Therefore, the practically horizontal heat fluxes at that level can be calculated from data on the mean temperature and resultant wind. The streamlines of turbulent heat fluxes coincide with the direction of the temperature gradient and, over the USSR in both January and July, are generally opposite to, or intersect at right angles the streamlines plotted on the basis of the average wind speed vector. Hence the total heat fluxes are vectorially somewhat smaller than the mean heat fluxes. Horizontal turbulent moisture fluxes make a more important contribution to the total moisture flux. At 1.5 km, the ratio of the turbulent moisture flux to the moisture carried by the mean motion fluctuates between 20 and 180%, and in July between 40 and 140%. Over the USSR, within a single season the regions of increased and reduced turbulence of the fluxes of the three considered substances coincide roughly, although the relative annual range of fluctuations for the different substances is different. The direction of the turbulent moisture fluxes almost coincides with that of the horizontal gradients of mean absolute humidity. Over the USSR regions where the turbulent moisture fluxes are integrated with the mean moisture fluxes, and, on the other hand, regions where the total moisture fluxes are weakened sharply as a result of oppositely directed fluxes of the two kinds. (Author abstract)

42004 **APTIC NO. 64291**

Makhonko, E. P., A. S. Avramenko, and K. P. Makhonko

TRACE ELEMENTS AND NATURAL RADIOACTIVITY IN CLOUD WATER AND ATMOSPHERIC PRECIPITATION IN THE CENTRAL CAUCASUS MOUNTAINS. *Main Administration of the Hydrometeorological Service (U.S.S.R.), Inst. of Experimental Meteorology, Proc. All-Union Conf. Nucl. Meteorol., Obninsk, U.S.S.R., 1969, p. 372-379. 14 refs. (June 23-28.) Translated from Russian. Israel Program of Scientific Translations, Jerusalem, 1974.*

NTIS: TT 7450011

Total concentrations of short-lived radon decay products in precipitation, cloud water and air were measured in summer on the Terksol peak of the Central Caucasus, along with the concentrations of iron, lead, manganese, nickel, and magnesium. The precipitation samples were taken in polyethylene vessels, the cloud-water samples were taken with the aid of a battery of four parallel cyclones, while the atmospheric aerosol samples were taken by means of a filtering setup with an FFP-15-1.5 filter. The admixture concentrations obtained are similar in the precipitation and the cloud water, as are the corresponding coefficients of admixture concentration (concentration ratios of water to air), i.e., the contamination of precipitation takes place mainly in the cloud. The assessed lifetimes of the trace elements in the atmospheric layers subjected to precipitation washout (1.4 days), concentration coefficient (6 times 10 to the 5th power), and rate of wet precipitation (1.2 km/day) correspond approximately to the values for natural radioactivity (2 times 10 to the fifth power and 0.8 km/day), and with literature data for macroelements and nuclear explosion products. This is an indication that the aerosol carriers of these admixtures in the atmosphere have similar properties, mainly similar particle sizes. (Author abstract)

42005 **APTIC NO. 64288**

Piskunov, L. I. and S. I. Tarasov

RELATION BETWEEN ATMOSPHERIC PRECIPITATION WASHOUT OF RADIOACTIVITY AND NONACTIVE IONS. *Main Administration of the Hydrometeorological Service (U.S.S.R.), Inst. of Experimental Meteorology, Proc. All- Union Conf. Nucl. Meteorol., Obninsk, U.S.S.R., 1969, p. 182-186. 32 refs. (June 23-28.) Translated from Russian. Israel Program of Scientific Translations, Jerusalem, 1974.*

NTIS: TT 7450011

A correlation in the form of a power relationship is assumed betwee the atmospheric washout of radioactive and nonactive contaminants. Chlorides and sulfates were selected as the latter, differing from the others in that their background ratio in atmospheric precipitation for the continental part of European USSR is stable. For a tropospheric background radioactivity, the constancy of the relation in atmospheric precipitation of the radioactivity q with respect to the chlorides m and the sulfates n follows from their identical washout laws. On the basis of the logarithmic equilibrium constants Pl log equals ((q+cl) to the l/bl power/m) equals constant P2 log equals ((q+cz) to the l/b2 power/n) equals constant (b1, b2, c1, and c2 are empirical parameters) it is possible to derive an approximate evaluation of the radioactive state of the atmosphere. To determine constants P1 and P2 requires observations with sufficient statistics subject to the conditions of the background concentratio of the contaminants. The absence of a correlation between dust washed out from the atmosphere, radioactive components, and the background concentration of nonactive ions can serve as an indicator of anomalous phenomena. (Author abstract modified)

42006 **APTIC NO. 64287**

Styro, B. I. and N. P. Dargene

SOME FEATURES OF ATMOSPHERIC CLEANSING BY GROUND CONDENSATION. *Main Administration of the Hydrometeorological Service (U.S.S.R.), Inst. of Experimental Meteorology, Proc. All-Union Conf. Nucl. Meteorol., Obninsk, U.S.S.R., 1969, p. 173-181. 6 refs. (June 23-28.) Translated from Russian. Israel Program of Scientific Translations, Jerusalem, 1974.*

NTIS: TT 7450011

Simultaneous measurements were made of the radioactivity of air and dew samples formed on the upper and lower surfaces of a polyethylene film spread on closely cut grass. The dew samples were collected in two ways: several identical films were spread simultaneously on the grass surface, the sample from the first film being taken immediately after the formation of the dew with subsequent sampling at hourly intervals throughout the night; alternatively, a single polyethylene film on the selected area was changed hourly and the radioactivity of the dew on it determined. The dew samples collected by the two methods were called old and new dew respectively. The short-lived alpha- radioactivity of the dew due to the decay of 84Polonium218, 82Lead214, and 83Bismith214 was determined. For old dew they lie in the range (0.1-24.5) times 10 to the minus 11 power curie/ml, and for the new dew in the range (0.1-26) times 10 to the minus 11 power curie/ml. The parameter of radioactivity removal from the air during the fall of dew is (0.02-1) times 10 to the minus 4 power/sec for old dew and (0.3-1) times 10 to the minus 4 power/sec for new dew. A parabolic relationship was obtained between the specific radioactivity of new dew and the specific radioactivity of the air, which points to the growth in washout intensity with increasing air radioactivity. The specific radioactivity and the coefficient of nonradioactive substances by old dew was studied as a function of the amount of fallen dew. Atmospheric cleansing occurs mainly through direct condensation of water vapor on radioactive aerosols and under the influence of electron interactions between the aerosol particles and the dewdrops. (Author abstract modified)

1967

42007 **APTIC NO. 63576**

Nester, K.

CONCENTRATION DISTRIBUTION AROUND A CONTINUOUS POINT-LIKE SOURCE AT ZERO WIND VELOCITY. DISCUSSION OF A PROPOSAL BY H. FORTAK. *(Distribution des concentrations autour d une source ponctuelle continue par vent nul. Discussion d une proposition de H. Fortak). Text in French. Ec. Polytech. Univ. Laus. Public, 68(100):13-16, 1967 (?). 5 refs.*

Sutton s and Fortak s methods for the calculation of the maximum ground level pollutant concentrations around continuously emitting punctiform emission sources are compared with special regard to very low and zero wind velocities as often occur in Switzerland. Calculations of the maximum ground level pollutant concentrations around a 100 meter-high emission source at zero wind speed for unstable and stable atmospheric conditions revealed that the concentrations obtained by Sutton s method are too high for the unstable conditions, and that for stable atmospheric conditions, the values calculated by Sutton s method are by one order of magnitude lower than those obtained by Fortak s method. Good approximation of the results is possible by introducing in Sutton s formula a wind speed of 0.5 m/sec for stable atmospheric conditions, and a wind speed of 1 m/sec for unstable conditions.

1962

42008 **APTIC NO. 63478**

Goetz, A.

THE ROLE OF AIR COLLOIDS IN THE LOWER ATMOSPHERE. *(Die Rolle der Luftkolloide in der unteren Atmosphaere). Text in German. Czechoslovak Academy of Sciences, Aerosols, Phys. Chem. Appl., Proc. Nat. Conf., 1st., Liblice, Czechoslovakia, 1962, p. 43-51. 21 refs. (Oct. 8-13.)*

Studies on the genesis, behavior, fate, and significance of air colloids in the atmosphere are reviewed. The highest particle size of atmospheric colloids is limited by the kinetic diameter-conditioned precipitation which is modified by vertical convection and thermal inhomogeneity. The lowest possible particle size corresponds to about 1000 molecules per particle. The smallest particles tend to disappear by forming larger particles of reduced motility. Inorganic colloids originate mainly in seawater containing largely the same salts as the latter, while organic colloids, typically metastable in their nature, originate from biological material, especially amines, present in seawater, from plants, and from anthropogenic sources, especially from combustion processes. Such organic colloids are subject to volatilization as well as to thermal and photochemical reactions with carbon dioxide, water, and possibly nitrogen oxides as end products. Such reaction products can considerably increase the mass of colloid particles by association processes, thus leading to e.g., photochemical smog. Such association can be intensified by relatively inert gases, such as sulfur dioxide in low concentrations. Atmospheric colloids adsorbing trace quantities of irritative substances, such as formaldehyde, may potentiate the irritative effect of the latter, but also abate this effect if adsorption occurs by chemisorption.

42009 **APTIC NO. 63506**

Kauf, H.

ORGANIC CONDENSATION NUCLEI AND WEATHER CONDITIONS. *(Organische Kondensationskerne und Wetterlage). Text in German. Czechoslovak Academy of Sciences, Aerosols, Phys. Chem. Appl., Proc. Nat. Conf. 1st, Liblice, Czechoslovakia, 1962, p. 585-588. 4 refs. (Oct. 8-13.)*

The airborne bacteria count was studied in Jena by means of slot type collector and by the scale method. The bacteria count reached up to 12,000 per cu m. Taking the bacteria count determined for summer as 100%, the percentages for winter, spring, and fall were 115%, 167%, and 252%. Increased bacteria concentration in inversion layers was determined. Microorganisms in a size range of 0.00004-0.00009 cm were able to act as condensation nuclei.

42010 **APTIC NO. 63500**

Lenz, K.

INFLUENCE OF AEROSOLS ON ATMOSPHERIC LIGHT SCATTERING. *(Einfluss des Aerosols auf die Lichtstreunng in der Atmosphaere). Text in German. Czechoslovak Academy of Sciences, Aerosols, Phys. Chem. Appl., Proc. Nat. Conf. 1st, Liblice, Czechoslovakia, 1962, p. 535-543. 11 refs. (Oct. 8-13.)*

Certain results obtained in a measurement program on skylight distribution and polarization, the spectral energy distribution of the sunlight and of the skylight, light extinction, light scattering by atmospheric aerosols, and light scattering in twilight are presented. Reduction of the skylight polarization due to the depolarizing effect of anthropogenic aerosols was observed. The distribution of the skylight polarization was determined essentially by the pure air layers in high altitude rather than by the aerosol-containing lower layers. Light scattering was most intense at angles near that of the sun. Industrial aerosols transmit the red components of light practically quantitatively, but they retain ultraviolet light.

42011 **APTIC NO. 63486**

Podzimek, J.

ON THE INFLUENCE OF STEFAN FLOW ON THE BINDING OF AEROSOL PARTICLES ON CLOUD ELEMENTS. *Czechoslovak Academy of Sciences, Aerosols, Phys. Chem. Appl., Proc. Nat. Conf., 1st, Liblice, Czechoslovakia, 1962, p. 173-179. 20 refs. (Oct. 8-13.)*

This paper deals with general mathematico-physical formulations of the mechanisms of the binding of aerosol particles on cloud elements, the surface of which changes either by condensation or by the evaporation of water vapor. In the neighborhood of a drop the gradient of the concentration of water vapor balances that of the air density so that the total density of the medium is constant. Since the surface of the evaporating water drop binds the molecules of water vapor but not those of the air, the molecules of which must diffuse towards the drop in the direction of the density gradient, there must exist hydrodynamical flow of the air away from the drop which compensates the diffusion. The process of binding small insoluble aerosol particles is the most intensive at small cloud particles increasing with condensation, i.e., when a cloud is formed in strongly unstable stratification or when the air expands rapidly. This is to be taken into consideration when determining the purifying effect of clouds and at the binding of practically insoluble nuclei of silver iodide on cloud elements. Under these favorable conditions Stefan s flow has a much greater influence than the electric charge and, in a certain range of particle size, than Brownian motion and microturbulence of the atmospheric flow. In the mature stage or even during decay a cloud may have an opposite effect in the sense that the drops will repulse insoluble aerosol particles. Similar processes on articulated ice crystals or on crystals in a mixed cloud are considered.

42012 **APTIC NO. 63498**

Podzimek, J.

THE IMPROTANCE OF AEROSOLS ON METEOROLOGY. *Czechoslovak Academy of Sciences, Aerosols, Phys. Chem. Appl., Proc. Nat. Conf., 1st. Liblice Czechoslovakia, 1962, p. 493-509. 54 refs. (Oct. 8-13.)*

The role of aerosols in meteorology is presented, with a diagram of some of the meteorology branches with the corresponding extreme sizes and physical characteristics of extant aerosols. An aerosol in meteorology means a finely dispersed system of the solid or liquid phase of a mass of air. The energy balance in the surface layer of the atmosphere and particularly actinometric measurements are basically influenced by atmospheric aerosol. Aerosols are the chief part of the physics of clouds. They play a role in agrometeorology and the study of meteorological conditions for the propagation of aerosols has created two new branches: stack meteorology and nuclear meteorology. Chemical analyses of precipitation or of atmospheric gases supplement the determination of the nature of aerosol particles in describing the chemical atmosphere. A diagram charts the spectral distributio functions of meteorological aerosols. Another chart shows the development of methods measuring meteorological aerosols. Certain sizes of aerosol particles of the same composition are produced above oceans and others primarily above dry land. Various theoretical models are presented which describe the processes by which aerosol particles get into the atmosphere. Stratospheric aerosols are growing in importance, involving a physical interpretation of the origin of noctilucent clouds, iridescent clouds, and twilight effects; possible verification of the Bowen hypothesis on the origin of precipitation on the Earth; and an interpretation of the origin of condensation nuclei in the ozonosphere and their transport to lower levels.

42013 **APTIC NO. 63505**

Volfova, E. and J. Horak

RESULTS OF MEASURING AITKEN NUCELI IN THE MOST REGION. *Czechoslovak Academy of Sciences, Aerosols, Phys. Chem. Appl., Proc. Nat Conf. 1st, Liblice, Czechoslovakia, 1962, p. 581-584. (Oct. 8-13.)*

A Scholz counter is used to measure Aitken condensation nuclei in the Most region. The Scholz counter reliably measures the concentration of condensation nuclei from tens to several thousands of nuclei/cu cm. The data are regarded as important information on the size of all particles contaminating the atmosphere in the range of radii considered. Condensation nuceli were measured in two places in the Most region, Komorany and Trebusice. The total amount of nuclei in each period of measurement was determined as the average from 10 samples of air. In both groups, sets of values of nuclei were compiled with regard to visibility, relative humidity, and the direction of the wind. Attention was also paid to the time dependence of the concentration of nuclei in periods of fog and on days when fog was not observed. The dependence of the occurrence of nuclei on these parameters was measured by a correlation ratio. The importance of the correlation ratio was tested for determining whether an observed correlation ratio is of higher importance than zero. Between the relative humidity of the number of nuclei in the Komorany measurements there is only a moderate fit. Higher concentrations were found during fog indicating the presence of a relatively large number of small condensation nuclei or aerosol particles which cannot bind on the much larger drops of fog. The abnormally high fall measured in Komorany must be ascribed mainly to coarse dispersion aerosol.

BASIC SCIENCE AND TECHNOLOGY

1974

42014 **APTIC NO. 63667**

Bowser, R. J. and F. J. Weinberg

ELECTRONS AND THE EMISSION OF SOOT FROM FLAMES. *Nature (London), 249(5455):339-341, May 24, 1974. 8 refs.*

The hypothesis that soot formation is associated with ionization in flames and may be controlled electrically was experimentally investigated. Nichrome wires coated with barium oxide and uncoated wires of diameter 0.2 mm were inserted at various heights into diffusion flames of propane diluted with argon, burning with air. The flames consisted of single, approximately flat, faces, which were contrived very simply by attaching a fishtail nozzle to the fuel burner tube and flowing off the second flame fact by an adjacent argon stream emerging from a similar nozzle. The results are in exact accord with the predictions of the hypothesis, in that it is the electron which produced effective effects characteristic of the additive. At heights where the additive promotes soot formation, application of a negative potential, encouraging the emission of electrons, greatly increases the effect, and the application of a sufficient positive potential prevents it altogether. The absence of soot formation in the case of positive ion emission casts doubt on previous suppositions that positive inorganic ions themselves act as nuclei.

42015 *APTIC NO. 65774*

Bragg, G. M., L. van Zuiden, and C. E. Hermance

THE FREE FALL OF CYLINDERS AT INTERMEDIATE REYNOLD S NUMBERS. Atmos. Environ., 8(7):755-764, July 1974. 10 refs.

A simple analytic model is developed to describe the unsteady rotation of circular cylinders in free fall. The model was tested against experiments made in the range of Reynold s number from 10 to the minus 2 power to 10. The agreement is good. The work has applications to the theoretical and experimental study of fibrous dusts and columnar ice crystals. (Author abstract)

42016 APTIC NO. 65788

Browne, L. W. B.

DEPOSITION OF PARTICLES ON ROUGH SURFACES DURING TURBULENT GAS-FLOW IN A PIPE. *Atmos. Environ., 8(8):8-1-816, Aug. 1974. 16 refs.*

A method for estimating deposition rates on rough surfaces in specific cases and to show the effect on deposition rates when various parameters are changed was evaluated. The general approach is the same as that used by Davies, but includes the effect of surface roughness. The rough surface theory and the trends are important in designing a system for sampling particulates or aerosols from the atmosphere or elsewhere. The effect of surface roughness on the friction velocity is dealt with by empirical equations. Details of the analysis are given together with a computer solution procedure. The calculations are in good agreement with experimental results. The effect of small changes in surface roughness on deposition velocity are so large that there is difficulty in making precise predictions of deposition rates. (Author abstract modified)

42017 APTIC NO. 65804

Buckle, E. Roy

NUCLEATION IN THE CONDENSATION OF AEROSOLS. *Chem. Ind., no. 12:475-478, June 15, 1974. 12 refs. (Presented at the Conference on Aerosol Physics, Southampton, England, Sept. 20-21, 1973.)*

The concepts and derivation of the simple theory of the rate of condensation in a vapor are presented and critically discussed. Special difficulties occur as the result of thermodynamic and kinetic oversimplifications. Laboratory works shows that the theory can be made to agree with experimental condensation retes only by the arbitrary adjustment of constants. Condensation aerosols frequently occur in processes that involve exothermic chemical reactions. Their formation accompanies the transport of vapor away from the reaction zone to colder regions by natural or forced convection. In cases where smoke or fume is the unwanted product of combustion, the nature of the condensation process has received little attention in comparison with the problem of cleaning the gaseous effluent. A theoretical approach is needed based on a simplified process model. (Author abstract modified)

42018 APTIC NO. 64146

Caragay, Alegria B., David A. Kendall, and Philip L. Levins

CHEMICAL ANALYSIS OF THE SMOKY-BURNT ODOR COMPLEX IN DIESEL EXHAUST. *Preprint, American Chemical Society, Washington D. C., 6p., 1974. 2 refs. (Presented at the American Chemical Society Division of Environmental Chemistry Meeting, Los Angeles, Calif., April 1974.)*

Odorous smoky-burnt compounds of diesel exhaust were identified by high resolution mass spectrometry, gas chromatography, and the use of reference compounds. A Fortran program of the complete high resolution mass spectral data was used to present all of the pertinent chemistry of the oxygenate group in a matrix organized by rings plus double bonds. The greatest contribution to the smoky-burnt odor appeared to be from the higher molecular weight components and those with multi-functional substitution, i.e., hydroxy and methoxy indanones with some contribution from methyl and methoxy phenols were associated with the smoky odor, while burnt odors were associated with furans and alkyl benzaldehydes.

42019 APTIC NO. 63864

Cheng, Lung

NOMOGRAM FOR RELATING PARTICLE AND PARTICLE CLOUD PARAMETERS. *J. Air Pollution Control Assoc., 24(7):680-681, July 1974.*

Three concentrations units -- mass density, number density, and surface area -- often are alternatively used to describe an aerosol cloud. While most aerosol clouds are composed of polydisperse particles, a nomogram based on monodisperse spherical particles is useful for relating these different concentration values. A nomogram constructed from these three independent functions is discussed. Dust concentrations of polydisperse particles can be determined in two ways. The first method is to determine the concentrations for each individual segment of the composite particle size from the nomogram and then to sum them to the total dust concentration. The second method is to obtain a single value of dust concentration from the nomogram using a proper mean particle size. For nonspherical particles, experimentally determined shape factors, such as sphericity, can be incorporated into the results obtained from the nomogram. An example is given for determining dust concentrations using these two methods.

42020 APTIC NO. 63791

Dianis, William and Joseph E. Lester

A STUDY OF NITRIC OXIDE ADSORBED ON NICKEL OXIDE, COBALT OXIDE, AND GRAPHITE BY X-RAY PHOTOELECTRON SPECTROSCOPY. *Surface Sci., 43(2):602-616, 1974. 34 refs.*

The nitrogen 1s binding energy of nitric oxide adsorbed on nickel oxide, cobalt oxide, and graphite was measured at several temperatures by X-ray photoelectron spectroscopy. For the oxides, a temperature-dependent range of binding energies was observed, but for graphite the nitrogen 1s binding energy was independent of temperature. The values obtained suggest that significant black donation of electrons occurs from the oxides to the adsorbed nitric oxides, but no back donation occurs from graphite to adsorbed nitric oxide. However, adsorption did not cause changes in the binding energy of substrate core electrons. Unless the mean free path of electrons is short, the total photoelectron signal will not reveal changes in binding energy of electrons from substrate atoms at the surface. (Author abstract)

42021 APTIC NO. 63786

Forney, Larry J. and Lloyd A. Spielman

DEPOSITION OF COARSE AEROSOLS FROM TURBULENT FLOW. *J. Aerosol Sci., 5(3):257-271, 1974. 22 refs.*

Experiments are reported for the deposition of Lycopodium spores (30.9 micron), Ragweed pollen (19.5 micron), Pecan pollen (48.5 micron), and polystyrene spheres (32 micron) on the inner walls of circular tubes under fully developed turbulent flow. Both tube diameter and air velocity were independently varied with inside tube diameters ranging from 1.3 to 4.4 cm and tube Reynolds numbers from 4 times 1000 to 6 times 10,000. Perfect sticking over the entire measured range was obtained with a wall coating mixture of 75% paraffin oil and 25% petroleum jelly. Because typical precautions to prevent rebound are ineffective, these are the first extensive measurements which, at the same time, correspond to both perfect sticking and particle stopping distances, which exceed the distance from the wall to the periphery of the turbulent core. The Lycopodium data, which were checked by independent methods for reliability, are in some disagreement with earlier data even where perfect sticking occurred for both. Core diffusion with free flight as the final transport step satisfactorily correlates data for both large and small stopping distances. (Author abstract modified)

42022 **APTIC NO. 65818**

Gentry, James W. and Chung H. Ahn

THE EFFECT OF FLOW RATE AND TEMPERATURE ON THE PARTICLE SIZE DISTRIBUTION OF LITHIUM BROMIDE AEROSOLS. *Atmos. Environ., 8(7):765-771, July 1974. 16 refs.*

Aerosols can be generated by condensation of a vapor of alkaline halides, but these compounds tend to be hydroscopic and to form chain like aggregates. Therefore lithium bromide was studied for generating aerosols. Lithium bromide was selected because it has approximately the same vapor pressure at 650-750 C as sodium chloride would have at temperatures of 850-950 C. Thus, aerosols having a diameter from 0.5 to 2 micron were obtained at relatively low temperatures, minimizing possible effects due to thermal gradients. The particle size distribution was measured as a function of flow rate and temperature using an Andersen cascade impactor. The mass median diameter increased with temperature and decreased with flow rate. The particle size range was described by a log-normal distribution a standard deviation parameter ranging from 1.6 to 2.0. The use of an inertial impactor to determine the particle size distribution seemed to be satisfactory at high temperatures and flow rates where four to six significant points were obtained. At lower temperatures and flow rates, only three to four significant points were obtained; consequently for these conditions an alternate method of particle size analysis is desirable.

42023 **APTIC NO. 63705**

Graham, R. A. and H. S. Johnston

KINETICS OF THE GAS-PHASE REACTION BETWEEN OZONE AND NITROGEN DIOXIDE. *J. Chem. Phys., 60(11):4628-4629, June 1974. 6 refs.*

Measurement of the rate constant for the reaction of nitrogen dioxide and ozone from 231 to 298 K is presented as important to stratospheric photochemistry. The reaction was studied in a 45-liter gas cell equipped with multiple reflection mirrors. The concentrations of nitrogen dioxide or ozone in the cell were followed by absorption spectrometry. The differential rate of the change of reactants was calculated point-by-point, and the data were interpreted primarily in terms of differential rates between 20 and 60% completion of reaction. Reaction stoichiometry was measured by switching back and forth between 255 nm (to measure O3) and 390 nm (to measure NO2). The stoichiometry was low, observed values being 1.89 + or - 0.08 (standard deviation), independent of temperature, on the basis of 25 measurements. The reaction of nitric oxide with O3 (a possible side reaction) is chemiluminescent, and this mechanism was tested by looking for this chemiluminescence. From the sensitivity of the method, it appears that less than 0.2% of the NO3 reacted to give NO.

42024 **APTIC NO. 64389**

Horvath, Helmut

FALLING PROPERTIES OF NON-SPHERICAL PARTICLES. *(Das Fallverhalten nicht-kugelfoermiger Teilchen). Text in German. Staub, Reinhaltung Luft, 34(7):251-256, July 1974. 10 refs.*

The dynamic shape factor is defined as the ratio of the flow resistance of an irregular particle to the flow resistance of a sphere of equivalent volume. It was determined by experiments in liquids. For this purpose steel models of aggregates of spheres, ellipsoids, cylinders, and cubes were used. It was possible to give these particles any desired orientation by means of a homogeneous magnetic field without exerting any additional force on them. The measurements performed in liquids can be applied to particles larger than 1 micron under normal conditions. With smaller particles the slip correction must be taken into account. Measurements performed in air on latex particles of 1 micron diameter agreed with the measurements in liquids.

42025 **APTIC NO. 64331**

Hoshida, I. and M. Nishimura

ADSORPTION OF SULFUR DIOXIDE ON POROUS POLYVINYLPYRIDINE RESINS. *Int. Chem. Eng., 14(2):374-380, April 1974. 19 refs. (Also: Nippon Kagaku Kaishi, no. 6:1195-1200, 1973.)*

The mechanisms of sulfur dioxide on a porous ion-exchange resin, polyvinylpyridine were studied. The reagents, preparation of porous vinylpyridine resins, preparation of 4-vinylpyridine polymer, preparation of hydrochloric acid salts of resins, synthesis of N-methyl-P-4VP, and the experimental apparatus are reviewed. The pore structures of various resins prepared under different polymerization conditions were determined with electron micrographs. At 30 C it took more than 90 min to attain an apparent adsorption equilibrium with P-4-VP-2 resin. The amount of SO2 adsorbed was greatest with P-4VP resins when the nitrogen atom was situated in the para position with respect to the polymer chain. The amount of SO2 adsorbed decreased in the following order: the P-2M-5VP resin which had the nitrogen atom in the metal position, the P-2VP resin with the nitrogen atom in the ortho position; and P-5E-2VP with the nitrogen atom in the ortho position. The adsorption capabilities of various P-2VP resins were almost independent of the poor size and the surface area. Adsorption of SO2 occurred at the active surface of the resin and inside the polymer. The adsorption capacity of the quaternary amine type N-M-P-4VP-2 resin obtained by the alkylation of nitrogen was superior to that of the P-4VP resin. The adsorption of SO2 on porous resins was described by a BET-type adsorption isotherm when the relative pressure was 0.3 or less. Thus, multi-molecular adsorption of SO2 took place. The adsorption capacities of the resins depended considerably on the relative position of the nitrogen atom of the pyridine ring with respect to the polymer chain. The heat of adsorption of the gas was studied to determine the strength of the adsorption of SO2. In general, the greater the heat of adsorption, the greater the affinity between the adsorbed gas and the adsorbent. Infrared adsorption of the HP-4VP film adsorbing SO2 was studied to show that interaction exists between the SO2 adsorbed and the pyridine group of the resin.

42026 **APTIC NO. 63905**

Izumikawa, Akio, Nobuo Ito, Masanao Funashima, Tomio Hirono, Hisaji Yokota, Masataka Sofuku, Kinji Nakano, Kunihiko Asakuno, and Toshio Odaira

THE RELATIONSHIP BETWEEN NITROGEN OXIDES, HYDROCARBONS AND PAN. *(Chisso sankabutsu, tanka suiso to PAN no kankei). Text in Japanese. In: Studies on Tokyo Smog. Tokyo Metropolitan Research Inst. for Environmental Protection (Japan), Rept. 3, p. 323-334, March 1974. 3 refs.*

Oxidants such as ozone and peroxyacetyl nitrate are formed in a reaction cycle involving nitric oxide, nitrogen dioxide, oxygen, and hydrocarbons by irradiation with ultraviolet light. Ozone, the most prevalent oxidant, is formed in the initial reaction of the smog formation cycle as a type of intermediate product, while the PAN is formed as a final product. Even a small amount of PAN is detrimental to humans and plants. At three locations in Tokyo, the concentrations of nitrogen oxides, HC, oxidant, O3 and PAN were measured during the summer of 1972 and 1973. The maximum PAN concentrations registered are 31.2 ppb (July 13, 1973) at Tokogaiken, 8.2 ppb (July 29, 1972) at Suginami, and 13.5 ppb (July 4 and 5, 1973) at Aoume. The value at Tokogaiken is comparable to the maximum concentrations measured at Riverside, California in 1967. The variation in PAN concentration with time was similar to that of oxidant. The ratio of O3 and PAN showed regional difference, which was probably attributable to the difference in residual equilibrium point of O3 in the NOx-HC-O3 system. In the supremum curve of non-methane HC vs. oxidant or PAN and NOx vs. oxidant or PAN, the higher O3 concentration is attained in the lower concentration region of NOx and nonmethane HC. Conversely, the higher PAN concentration is attained at the higher concentration region of NOx and nonmethane HC. The consumption of HC and NOx at the time of smog formation increases with the increase in oxidant and PAN concentration.

42027 **APTIC NO. 63741**

Kanamaru, Kazuhiro, Shunichi Daito, and Akira Fukami

OVER-SHOOT PHENOMENA OF OH, O, AND H RADICALS, AND THE FORMATION PROCESS OF NITRIC OXIDE (PART I). *(OH, H, H rajikaru no over-shoot gensho to NO no seisei katei. I). Text in Japanese. Preprint, Japan Society of Mechanical Engineers, Kansai, p. 57-60, March 1974. 10 refs. (Presented at the Japan Society of Mechanical Engineers, Kansai Branch Meeting, 49th, Higashiosaka, Japan, March 19-20, 1974, Paper 3407.)*

Based on a total of 29 elementary reactions (14 for methane oxidation; eight for hydrogen, oxygen, and water; and seven for acetylene oxidation), the variations in hydroxide, hydrogen, and oxygen radical concentration in the auto-ignition process of methane and acetylene were calculated. The results are shown in diagrams with the identification of contributory elementary reaction for each radical formation. The OH radical is formed first by the reaction of CH3 produced by the pyrolysis of methane. The disappearance reactions of the OH radical by CH4 + OH equals CH3 + water and formaldehydes + OH equals HCO + H2O occur simultaneously, balancing with the formation reaction without producing over-shoot phenomenon. As the concentration of HCO increases, the over-shoot phenomenon of H is induced, which subsequently leads to the over-shoot of OH and O by H + O2 equals OH + O. The direct cause of over-shoot by HCO + M equals CO + H + M was examined, based on various thermodynamic data.

42028 **APTIC NO. 63742**

Kanamaru, Kazuhiro, Shunichi Daito, and Akira Fukami

OVER-SHOOT PHENOMENA OF OH, O, AND H RADICALS, AND THE FORMATION PROCESS OF NITRIC OXIDE (PART II). *(OH, O, H rajikaru no over-shoot gensho to NO no seisei katei. II). Text in Japanese. Preprint, Japan Society of Mechanical Engineers, Kansai, p. 61-63, March 1974. 16 refs. (Presented at the Japan Society of Mechanical Engineers, Kansai Branch Meeting, 49th, Higashiosaka, Japan, March 19-20, 1974, Paper 3408.)*

In the previous report, the theoretical approach to the auto ignition process of fuels was made in terms of temperature variation and by ignoring the diffusion of chemical substances. However, the transportation of chemical substance is a great factor in the actual combustion process. The average temperatures in the reaction zone obtained by the calculation are greatly shifted toward the higher temperature zone compared to the average temperatures given by Tiggelen, which can be accounted by the initiation reactions involved. The radical concentrations obtained by calculations were several times higher than the actual radical concentrations. This is attributable to the direct diffusion of radicals and the decrease in hydroxide and oxygen radicals over-shoot which is dependent on the hydrogen over-shoot due to the reduction in reaction rate in the lower temperature zone. Nine known elementary reactions involved in the formation of nitric oxide are given, among which the Zeldovich s mechanisms are the major reaction route for the NO formation. However, at equivalent ratio phi equals 1.2 or over, the calculated values deviated greatly from the measured value. Therefore, the formation of prompt NO is unaccountable by this mechanism.

42029 **APTIC NO. 63828**

Knettig, P. and J. M. Beeckmans

INERTIAL CAPTURE OF AEROSOL PARTICLES BY SWARMS OF ACCELERATING SPHERES. *J. Aerosol Sci., 5(3):225-233, 1974. 6 refs.*

The deposition of aerosol particles on swarms of accelerating spherical glass beads and studied over a range of aerosol particle sizes and air velocities, and two glass bead sizes. The results were interpreted by the theoretical model which was based on equations valid for inertial impaction and interception of spheres on single, stationary spheres, and which included and empirical factor dependent on the volumetric concentration of the collection particles. At very low bead fluxes, and for particles for which the impaction efficiency is not too small, the single bead impaction and interception equations are valid for deceleration of the collector particles relative to the fluid, and in the presence of considerable turbulence in the fluid upstream of the collector particles. The relevance of these studies to particulate control and to the fundamentals of aerosol mechanics derives from the fact that control was maintained over the particle size of the collector particles, in contrast to similar situations in the more common studies on collection by liquid droplets.

42030 **APTIC NO. 63788**

Landreth, Ronald, Rosa G. de Pena, and Julian Heicklen

THERMODYNAMICS OF THE REACTIONS (NH3)N. SO2(S) AND ITS REVERSE NNH3 PLUS SO2(G). *J. Phys. Chem., 78(14):1378-1380, 1974. 4 refs.*

Anhydrous sulfur dioxide and ammonia were allowed to react to form their solid adducts. Equilibrium vapor pressures for each gas were measured at 5, 15, 24.5, 35, and 45 C. The reaction in NH3.SO2(s) and its reverse NH3(g) + SO2(g) with ln K(sq atm) equals delta S/r - delta H/RT where K is the equilibrium constant, delta S equals 15.3 cal/mol degree K, and delta H equals 9.5 kcal/mol to within + or - 10% uncertainty. The equilibrium was unaffected by the presence of excess oxygen or nitrogen. With excess NH3 at the lowest two temperatures, there was thermodynamic evidence for the production of the (NH3)2.SO2 adduct. For the reaction (NH3)2.SO2(s) and its reverse 2NH3(g) + SO2(g) the thermodynamic functions are crudely estimated to be delta S is approximately 82 cal/mol degree K and delta H is approximately 23 kcal/mol with at least + or - 20% uncertainty. (Author abstract)

42031 **APTIC NO. 63560**

Lencioni, Donald E. and J. E. Lowder

AEROSOL CLEARING WITH A 10.6-MICRON PRECURSOR PULSE. *IEEE Inst. Elec. Electron Engrs. Quantum Electron., QE-10(2):235-238, Feb. 1974. 13 refs.*

Aerosol clearing experiments were performed in which the breakdown threshold for a 10.6 micron, 200 ns laser pulse in air filled with carbon particles was increased by application of a low intensity high-influence precursor pulse. The threshold was raised to within a factor of approximately 3 of clean air with a 40 J/sq cm precursor when the beam contained many particles with diameters less than or equal to 4 micron. The presence of 50 micron particles in the beam resulted in the threshold being raised a factor of approximately 19 which was within a factor of 2 of clean air. Vaporization of small particles and the jetting of larger particles out of the beam appeared to be the mechanisms responsible for the particle clearing. (Author abstract modified)

42032 **APTIC NO. 63833**

Loffler, F. and W. Muhr

GENERATION OF MONODISPERSED SOLID PARAFFIN AEROSOL PARTICLES IN THE 1-10 MICRON SIZE RANGE BY MEANS OF A SINCLAIR LA MER TYPE GENERATOR. *(Die Erzeugung von monodispersen festen Paraffinpartikeln im Bereich 1-10 um mi einem Generator* *vom Typ Sinclair La Mer). Text in German. Inst. National de Recherche Chimique, Appliques (France), Inst. Natl. Rech. Chim. Appl., 11 eme, Collog, Atmos. Polluees, Proc., Paris, France, 1974, 11p. (May 8-10, Paper 23.)*

The generation of spherical solid paraffin particles in the 1-10 micron range by means of a Sinclair La Mer aerosol generator is described. The paraffin aerosol is obtained on condensation nuclei that had been generated by the evaporation of a thin sodium chloride layer from a heated platinum wire, and had been entrained and carried through paraffin vapor at 220-280 C by a nitrogen stream at a flow rate of 30-40 l/hr. The mean particle diameter increased with increasing nitrogen flow rate. The median diameter had a variation of + or - 0.5 micron, and it was practically constant during continuous 24-hour operation of the aerosol generator. The growth of large particles was slightly retarded by the condensation heat released in the course of the condensation of paraffin vapor on the submicroscopic sodium chloride particles.

42033 **APTIC NO. 63604**

Ma, Y. H. and R. B. Belmonte

EXPERIMENTAL INVESTIGATION OF MULTICOMPONENT RATES OF SORPTION OF SO2 AND CO2 IN NATURAL MORDENITE AND CLINOPTILOLITE. *Preprint, American Inst. of Chemical Engineers, New York, 17p., 1974. 15 refs. (Presented at the American Institute of Chemical Engineers National Meeting, 76th, Tulsa, Okla., March 1974, Paper 44B.)*

Transient sorption rates in natural mordenite and clinoptilolite of dilute mixtures of sulfur dioxide and carbon dioxide in helium were investigated in a well stirred, constant volume system at various temperatures and partial pressures of CO2 and SO2. The effect of CO2 upon the rate of sorption and the equilibrium capacity of SO2 was relatively small. The sorption of CO2 was greatly affected by the presence of SO2. When CO2 was pre-adsorbed on the natural mordenite and clinoptilote, adding SO2 caused an almost complete desorption of CO2. Just after the SO2 and CO2 mixture was injected into the system, the coverage of the internal surface of the molecular sieves was small, and both CO2 and SO2 diffused into the sorbent, with CO2 advancing more rapidly. When enough molecules of CO2 and SO2 were sorbed to attain a certain degree of coverage of the surface, SO2 continued to be sorbed on less active sites. The SO2 started to complete with CO2 on sites which were previously occupied by CO2. As SO2 had a larger affinity for the surface, CO2 was desorped. (Author conclusions modified)

42034 **APTIC NO. 63789**

Madey, Theodore E., John T. Yates Jr., and Nils E. Erickson

X-RAY PHOTOELECTRON SPECTROSCOPIC STUDY OF THE ADSORPTION OF N2 AND NO ON TUNGSTEN. *Surface Sci., 43(2):526-544, 1974. 33 refs.*

X-ray photoelectron spectroscopy (ESCA) is used in a study of nitrogen and nitric oxide adsorbed on a polycrystalline tungsten ribbon. The sample was flash cleaned under ultrahigh vacuum conditions, and cooled to either 300 K or 100 K for the adsorption studies. Large chemical shifts, as great as 8 eV, were observed between the N(1s) spectra associated with the weakly chemisorbed gamma-nitrogen states and the strongly chemisorbed beta-nitrogen states. Chemical shifts in both the N(1s) and O(1s) spectra suggest that NO is largely non- dissociatively chemisorbed at 100 K. The binding energies of N(1s) and O(1s) electrons in the adsorbed layers are smaller than the binding energies for the same atoms in small gaseous molecules. The binding energies associated with the weakly-bound states of NO and N2 are invariably greater than the binding energies associated with strongly chemisorbed species. (Author abstract)

42035 **APTIC NO. 66084**

McLaren, Eugene, Andrew J. Yencha, Joel M. Kushnir, and Volker A. Mohnen

SOME NEW THERMAL DATA AND INTERPRETATIONS FOR THE SYTEM SO2- NH3-H2O-O2. *Tellus (Uppsala), 26(1-2):291-294, 1974. 11 refs.*

Thermal data were obtained for gas-phase reactions in systems consisting of ammonia and sulfur dioxide; NH3, SO2, and oxygen: NH3, SO2, and water vapor; and NH3, SO2, O2, and water vapor. A special calorimeter was constructed with capability for rapid injection of gases, a magnetically driven stirrer, and a fast-reacting thermocouple. The reaction enthalpy was -30 kcal/mole for the anhydrous reaction of SO2 with NH3, with the presence of oxygen having no effect on that value. With water vapor present, the enthalpy went to -34 and -45 kcal/mole in the absence and presence of oxygen, respectively, indicating the importance of water to rapid oxidation in the system. The relationships of these results to other thermal information, together with the implications for the atmospheric SO2 cycle and particulate formation, are discussed. (Author abstract)

42036 **APTIC NO. 63971**

Mizutani, Yukio and Masashi Kozuki

THEORETICAL ANALYSIS OF GAS TURBINE COMBUSTORS (REPORT 2). *(Gasu tabin nenshoki nonriron kaiseki dainiho). Text in Japanese. Preprint, Japan Society of Mechanical Engineers, Kansai, p. 54-56, March 1974. 8 refs. (Presented at the Japan Society of Mechanical Engineers, Kansai Branch Meeting, 49th, Higashiosaka, Japan, March 19-20, 1974, Paper 3406.)*

Theoretical equations for the estimation of nitric oxide emission from a turbine combustor using an analytical model were derived, based on the Zeldovich s formation mechanism of NO. The calculated values for the distribution of temperature, equivalent ratio, and NO concentration at 300 K, 1 atm and an air-fuel ratio equaling 65 were compared with those of the measured values. The data on the effect of air-fuel ratio, inlet air temperature, and pressure on the emission rate of NO are given in diagrams. The NO formation rate increased greatly with the rise in inlet air temperature. The maximum NO concentration and outlet NO concentration were both doubled by the 100 K rise in temperature. The NO concentration also increased markedly with the increase in pressure, however, the effects of decrease in flow rate due to the pressure increase and the resulting prolongation in residence time were contributing factors. Theoretically derived equations were valid with a fairly high degree of accuracy.

42037 **APTIC NO. 63468**

Musick, J. K. and F. W. Williams

CARBON-MONOXIDE-INDUCED PARTICLES FROM HOPCALITE CATALYST. *Preprint, American Chemical Society, Washington, D. C., 5p., 1974. 4 refs. (Presented at the American Chemical Society Division of Environmental Chemistry Meeting, Los Angeles, Calif., March 31-April 5, 1974.)*

Hopcalite catalysts were investigated at 315 C to determine if they emit particle matter when subjected to atmospheres containing carbon monoxide and hydrocarbons. Hopcalite and CO do react and emit particles in the size range of 10 to the -7th power to the -5th power cm radius. Particle emission start immediately when the hopcalite is exposed to the CO, but decay at a slow rate for 4 hr after the CO exposure ends. Emission of particles did not start anew after the catalyst was rested overnight. The CO is efficiently converted to carbon dioxide. There are no metal carbonyls formed which indicates the presence of transient or intermediate materials which could be the source of the particles.

42038 **APTIC NO. 65775**

Obuchi, Akira, Tetsuichi Han Akitsugu Okuwaki, and Taijiro Okabe

THE REACTIONS OF SALTS OF MANGANESE OXOACIDS WITH OXIDES OF NITROGEN. *(Chisso sankabutsu to mangan no okiso-san en to no hanno). Text in Japanese. Nippon Kagaku kaishi (J. Chem. Soc. Japan), no. 8:1461-1467, Aug. 1974.*

Absorption reactions of nitrogen oxides in potassium manganate or permanganate solution and of nitric oxide on potassium permanganate crystals 300-600 C were investigated. The oxidation of nitrite with permanganate occurred immediately after the absorption if the amount of potassium hydroxide was insufficient. In a neutral solution, the oxidations proceeded quickly. Nitrogen oxide was absorbed well by K2MnO4 crystals or a mixture of manganese dioxide and KOH at 300-600 C. A mixture of K2MnO4 and KOH absorbed at lower temperatures, and had absorbed more NO per mole K2MnO4 than K2MnO4 alone.

42039 **APTIC NO. 63547**

Olsson, R. G. and E. T. Turkdogan

CATALYTIC EFFECT OF IRON ON DECOMPOSITION OF CARBON MONOXIDE: II. EFFECT OF ADDITIONS OF H2, H2O, CO2, SO2 AND H2S. *Met. Trans., vol. 5:21-26, Jan. 1974. 14 refs.*

The effect of additions of hydrogen, water, carbon dioxide, sulfur dioxide, and hydrogen sulfide on the catalytic decomposition of carbon monoxide by porous iron was investigated at 400, 600, and 800 C and atmospheric pressure, with the relative importance of carbon deposition being determined as a function of hydrogen concentration for the reactions CO decomposing to C (soot) + CO2 and H2 + CO going to C + H2O. Even low concentrations of H2 greatly enhanced the rate of CO decomposition, presumably by a catalytic action of adsorbed H2 on iron. The presence of water vapor had a dual effect; at low concentrations of H2 the rate of decomposition of CO increased with the addition of H2O, while at high concentrations of H2 carbon deposition was retarded. The rate of carbon deposition decreased with increasing CO2 content in CO-CO2 mixtures. The presence of traces of sulfur- bearing gaseous species, such as SO2 and H2S, retarded the decomposition of CO on iron and brought about the early cessation of carbon deposition, perhaps due to the retardation of the decomposition of the intermediate product, cementite, and the formation of pyrrhotite on the surface of the iron catalyst. (Author abstract modified)

42040 **APTIC NO. 63787**

Scott, David S. and Donald F. Rennick

ON THE DYNAMICS OF SMALL AEROSOL PARTICLES. *J. Aerosol Sci., 5(3):301-315, 1974. 13 refs.*

Matters related to the difference between the typical trajectory of an individual Knudsen particle and the mean trajectory of a cloud of such particles are introduced. To illustrate these matters, a statistical numerical procedure which yields individual particle trajectories is presented. The success of the procedure in a relatively straightforward physical circumstance suggests that its extension to the modeling of more complex situations is plausible. The proper interpretation and limitations of recent free-molecular and transition theories as they apply to small aerosol particles are discussed. Examples from the literature are used to illustrate the arguments presented. Particle random thermal motion is important to the dynamics of Knudsen particle aerosols, and its relation to transition and free- molecular mean-force theories must be appreciated when applying such theories. (Author abstract modified)

42041 **APTIC NO. 64368**

Sebayashi, Tsutae

PHOTOCHEMISTRY OF AIR POLLUTION-PHOTOCHEMICAL REACTIVITY AND DECOMPOSITION OF OXYGEN ATOMS AND MOLECULES. *(Taiki kokagaku hanno—sono sanso no kyodo ni tsuite). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 10(5):81-87, May 1974. 30 refs.*

The photochemical characteristics and chemical properties of oxygen and ozone at ground and excited states and the contributory role of these O-type molecules to the atmospheric photochemical reaction are described. The bond property of atmospheric compounds of simple diatomic molecules such as nitrogen, O2, carbon monoxide, and nitric oxide are discussed in relation to the ionization potential and electron affinity. The bond properties of triatomic molecules such as O3, water, hydrogen sulfide, nitrogen dioxide, and sulfur dioxide are reviewed. The O2 at ground state is in triplet state, while the O2 in excited state are in two types of singlet states and one triplet state. The relationship between the O2 at excited state and electron spectrum and the spectrum of excited O3 are reviewed. In atmospheric photochemical reactions, the reaction between the active O in the singlet state and NOx or hydrocarbon plays an important role. The properties of singlet state O produced by the photoexcitation or photoreaction of O3 are given. The formation of the O atom by the photoexcitation and the reaction of O atom with other inorganic and organic compounds related to the photochemical reaction (photochemical smog) are described. In the atmospheric photochemical pollution, oxidants such as O3, aldehydes, and peroxyacetyl nitrate are produced by the photochemical reaction of atmospheric pollutants such as NOx and HC by complex reaction mechanisms.

42042 **APTIC NO. 66032**

Smith, Jerome P. and Paul Urone

STATIC STUDIES OF SULFUR DIOXIDE REACTIONS: EFFECTS OF NO2, C3H6, AND H2O. *Environ. Sci. Technol., 8(8):742-746, Aug. 1974. 28 refs.*

Static studies of sulfur dioxide dark and photochemical reactions at 2 ppm in the air in the presence of nitrogen dioxide, propylene, and water are reported. The initial photochemical reaction rate of SO2 alone in air was 1.7 times 10 to the minus 4th power ppm/min. In the presence of NO2, the rate increased when the SO2 to NO2 ratio was 1 or 2, but decreased at a ratio of 0.6 or less. When propylene and NO2 were both present, the reaction rate increased 100 fold depending upon the amount of propylene as well as the SO2 to NO2 ratio. At 50% relative humidity, the SO2-NO2 reaction rate increased tenfold, but the SO2-NO2-C3H6-H2O system reacted in the dark and showed erratic photochemical reaction rates. These trends can predict air pollution conditions. Hydrocarbons contribute an important mechanism of SO2 removal, and high or very low concentrations of nitrogen oxides inhibit SO2 removal. Water vapor can contribute to SO2 removal, particularly at high relative humidities. (Author abstract modified)

42043 **APTIC NO. 63902**

Sofuku, Masataka

PHOTOCHEMICAL REACTION IN THE ATMOSPHERE. *(Taikichu ni okeru kokagaku hanno). Text in Japanese. In: Studies on Tokyo Smog. Tokyo Metropolitan Research Inst. for Environmental Protection (Japan), Rept. 3, p. 225-241, March 1974. 34 refs.*

The formation mechanism of photochemical smog is not completely understood. Various published reports on the formation mechanism of photochemical smog are reviewed. The basic theory of photochemical reaction and photochemical reaction mechanisms proposed by Blacet, Haagen-Smit, Wayne, Leighton, Tuesday, and Stephens are systematically reviewed. The nitrogen oxides contained in the exhaust from high temperature combustion is mostly nitric oxide. However, nitrogen dioxide is known to be the initiator of photochemical reaction, and therefore atmospheric NO has to be oxidized to NO2 to be involved in the photochemical reaction. Various studies on the oxidation mechanism of NO to NO2 are reviewed with equations and data. The oxidation mechanism of NO to NO2 is not yet clearly established. The role of hydrocarbons in the reaction mechanism initiated by the photodecomposition of NO2 cannot be ignored. The reactivity of HC in the photooxidation reaction in the presence of NOx is discussed. The formation mechanism of peroxyacyl nitrates proposed by Stephens, Hanst and Sensaka are reviewed. The photochemical reaction mechanism of sulfur dioxide, the reaction in the SO2-NOx-HC system, and the formation of aerosol are also discussed.

42044 **APTIC NO. 63967**

Straubel, H.

CHANGE CAUSED IN LIGHT-SCATTERING BY MOISTURE UPTAKE BY WATER- SOLUBLE AEROSOLS. *(Veraenderung der Lichtstreuung bei der Fechte-Aufnahme wasserloeslicher Aerosole). Text in German. Inst. National de Recherche Chimique Appliquee, (Inst. Natl. Rech. Chim, Appl. (France), 11eme, Colloq. Atmos Polluees, Proc., Paris, France, 1974, 7p., 2 refs. (May 8-10, Paper 30.)*

Changes caused in light-scattering by moisture uptake in water- soluble, hygroscopic aerosol particles were studied in a three- plate condenser with d.c. on the two plates and a.c. on the middle plate. This arrangement is suitable for the determination of the charge-mass ratio, while the mass is subsequently determined from the diffraction occuring during irradiation with laser beams. In this manner it was possible to continuously observe moisture uptake and loss in hygroscopic cobalt chloride particles. When the relative humidity in the condenser was increased to over 50%, the cobalt chloride crystal started taking up moisture very rapidly and dissolved. In saturated solutions, the photoelectric current was proportional to the third power of the particle radius, which is indicative of the presence in the droplets of solid particles contributing to light scattering. In undersaturated solutions, the photoelectric current was proportional to the square of the particle radius.

42045 **APTIC NO. 63652**

Strokin, V. N. and V. M. Khaylov

ON THE INFLAMMATION-RETARDING EFFECT OF NITRIC OXIDE ON HYDROGEN IN AIR. *(K voprosu o yliyanii okisi azota na zaderzhku vosplameneniya vodoroda v vozdukhe). Text in Russian. Fiz. Goreniya Vzryva, no. 2:230-235, 1974. 9 refs.*

The inflammation-retarding effect of nitric oxide in the high-temperature oxidation of hydrogen, as occurs in explosions, was studied in a kinetic model including molecular oxygen, hydrogen, hydrogen peroxide, molecular nitrogen, atomic oxygen, hydrogen and nitrogen, as well as NO and nitrogen dioxide. In stoichiometric mixtures of hydrogen with air, NO inhibited the pre-inflammation reactions. A considerable increase in the induction period at NO concentrations of 3-5% was observed. In a range of 0.8-1.25, the air-excess coefficient had no effect on the period of induction that was between 0.000598 and 0.000643 sec, just as in pure hydrogen-air mixtures. The inhibitory effect of NO intensifies with lowering the temperature, while at temperatures over 1200 K, NO slightly reduces the induction period. Rapid increase in the effect of NO with increasing pressure over 1 atm was observed. The effect of NO on the inflammation of hydrogen in such mixtures is conditioned by concurrent trimolecular reactions.

42046 **APTIC NO. 65781**

Sugioka, Masatoshi and Kazuo Aomura

STUDIES OF THE CRACKING REACTIVITY OF ORGANIC SULFUR COMPOUNDS (PART I)--THERMAL CRACKING REACTIVITY OF ALIPHATIC MERCAPTANS IN THE ABSENCE OF CATALYST. *(Yuki io kagobutsu no bunkai hannosei ni kansuru kenkyu (sono 1)). Text in Japanese. Hokkaido Daigaku Kogakubu Kenkyu Hokoku (Bull. Fac. Eng., Hokkaido Univ.), no. 71:1-7, June 1974. 8 refs.*

The thermal cracking reactivity of various aliphatic mercaptans in a helium stream was investigated with a pulse reactor. A linear relationship was observed between the logarithms of the apparent first order rate constants of this reaction of aliphatic mercaptans and the bond dissociation energy of carbon-sulfur bond in mercaptan molecules. The thermal cracking reactivity of aliphatic mercaptans depends on the bond strength of the C-S bond in mercaptan molecule.

42047 **APTIC NO. 66041**

Sullivan, K. M.

CHARACTERISTICS AND ELECTROSTATIC PRECIPITABILITY OF FLY ASH FROM A LABORATORY EXAMINATION OF LOW SULPHUR COALS. *Clean Air (J. Clean Air Soc. Australia New Zealand), 8(2):33-36, May 1974. 5 refs.*

The characteristics and electrostatic precipitability of fly ash were determined from a laboratory examination of low sulfur coals. Particular reference was made to the electrical resistivity, current applied voltage corona characteristics, and adhesive properties. There was no correlation between mineral constituents in the fly ash or size distribution of the fly ash and resistivity in either the bone dry or moist conditioned state. Multiple correlation coefficients varied from 0.18 to maximum of 0.59 for these analyses. The attempted correlation between fly ash and resistivity in both the bone dry and moist gas conditioned state and ash content, forms of sulfur, and total S, again yielded no correlation, with multiple correlation coefficients varying from 0.51 to 0.69. (Author abstract modified)

42048 **APTIC NO. 64148**

Tevault, David E. and Lester Andrews

LASER RAMAN MATRIX ISOLATION STUDIES OF NITROGEN DIOXIDE. RESONANCE RAMAN SPECTRUM OF NO2 AND RAMAN SPECTRUM OF N204. *Spectrochim. Acta, vol. 30A:969-975, 1974. 28 refs.*

Argon matrix samples of nitrogen dioxide were extensively studied using argon ion laser excitation; and in marked contrast to the gas phase spectrum where many intense fluorescence lines exist, the matrix spectrum exhibited sharp Raman bands for dinitrogen tetroxide and sharp resonance Raman bands for NO2. Observation of first overtones with one-fourth of the fundamental intensity characterized the NO2 spectra as resonance Raman. Sample warming operations caused signals due to the three symmetric N204 modes to increase in intensity at the expense of the symmetric NO2 fundamentals.

42049 **APTIC NO. 63635**

Timoshenko, V. I.

CALCULATION OF THE DIFFUSIVITY OF AEROSOL PARTICLES IN A SOUND FIELD. *Sov. Phys.-Acoust., 19(5):504-505, March-April 1974. 4 refs. (Also: Akust. Zh., vol. 19:790-791, Sept.-Oct. 1973.)*

The particle diffusivity associated with vibrational motion of the medium is needed for a description of many mass transfer processes in high-intensity sound fields. The determination of the diffusivity of aerosol particles in a sound field is of fundamental significance in formulating the equations for the kinetic process of acoustic coagulation. Equations are presented to calculate this aerosol diffusivity. The variation of the mobility of small particles in a sound field causes a sizable deviation (as much as twofold) of the diffusivity from the Einstein value. In the calculations, allowance was not made for the temperature variation in the sound field, because the influence of this factor on the diffusivity is very slight; the variation amounts to about 0.1% of the Einstein value of diffusivity.

42050 **APTIC NO. 63546**

Turkdogan, E. T. and J. V. Vinters

CATALYTIC EFFECT OF IRON ON DECOMPOSITION OF CARBON MONOXIDE: I. CARBON DEPOSITION

IN H2-CO MIXTURES. Met. Trans., vol. 5:11-19, Jan. 1974. 18 refs.

Hematite ore reduced with hydrogen was used as a catalyst to investigate the rate of decomposition of carbon monoxide in H2-carbon monoxide mixtures. Although the amount of carbon deposited from purified CO was directly proportional to the amount of porous iron catalyst present in the system, this simple relation did not hold for H2-CO mixtures. The porous Fe granules disintegrated and were dispersed evenly in the carbon deposit during carbon deposition. The deposit consisted of graphite, cementite, and Fe, with the cementite to Fe ratio increasing as more soot accumulated. Carbon deposition ceased when most of the Fe was converted to cementite. A small amount of H2 enhanced markedly the rate of decomposition of CO. Indications are that H2 adsorbed on Fe catalyzes the decomposition of CO to carbon and carbon dioxide in addition to the occurrence of H2 reacting with CO to give C and water vapor. (Author abstract modified)

42051 **APTIC NO. 65784**

Usami, Seiji, Toshinobu Nakazima, and Keizo Ohno

THE SURFACE POTENTIAL OF NITRIC OXIDE ON TUNGSTEN. *Bull. Fac. Eng., Yokohama Nat. Univ., 23(2):233-238, March 1974. 13 refs.*

The surface potential of nitric oxide on a polycrystalline tungsten foil was determined. At room temperature it is 1.54 plus or minus 0.08eV. In the measurement of the contact potential difference by the Kelvin technique, a mesh-like electrode was used as a reference to permit more gas to collide with the inner surface of the specimen which was closely placed to the reference electrode. (Author abstract modified)

42052 **APTIC NO. 63445**

Valitov, N. K., F. K. Ibragimov, G. F. Malyatova, and V. M. Lysikov

STUDY OF THE ADSORPTION OF SO2, SO3, AND O2 ON A SULFOVANADIUM CATALYST. *(Issledovaniye adsorptsii SO2, SO3 i O2 na sul fovanadiyevom katalizatore). Text in Russian. Zh. Prikl. Khim., no. 3:550-554, 1974. 11 refs.*

The kinetics of the adsorption and desorption of sulfur dioxide, sulfur trioxide, and oxygen during the catalytic oxidation of SO2 to SO3 on silica gel-supported potassium pyrosulfovanadate catalyst with a particle size of 0.25-0.5 mm was studied by the direct chromatographic method. After a reduction of the catalyic activity in a temperature range of 420-470 C, the activity largely stabilized between 470 and 590 C. Reduction of the retention time with increasing SO2 volume up to a certain line on presaturated catalyst, and no dependence of the O2 retention time of the O2 volume on unsaturated catalyst were observed. The rate of the catalyst charge increased with increasing SO2 volume without any change in the desorption activation energy. The activation energy of SO2 desorption increased with rising temperature. The retention time, and hence the bond energy was highest for SO2, and lowest for SO3.

42053 **APTIC NO. 64376**

Wolf, Friedrich and Rudolf Haase

STUDIES OF THE PROPERTIES OF VANADIUM CATALYSTS DURING SO2-OXIDATION. *(Untersuchungen zum Verhalten von Vanadinkatalysatoren waehrend der SO2-Oxydation). Text in German. Chem. Tech. (Berlin), 26(7):400-402, July 1974. 9 refs.*

Changes of vanadium catalysts during sulfur dioxide oxidation were studied under adiabatic starting reactions. Freshly manufactured vanadium catalysts of the type WNF 6 with the outer sleeve and inner core measuring 3mm were used. The catalytic activity of the catalysts was measured in the laboratory under isothermal conditions with a reaction gas composed of 7% by volume SO2, 10.5% by volume oxygen and 82.5% by volume nitrogen. In addition, microscopic examinations of unused and used V catalysts were performed and changes of chemical composition determined. The catalytic oxidation of SO2 on V catalysts is in general of topochemical nature. If the sulfur trioxide synthesis approaches isothermal conditions (small SO2 volume concentrations) the V catalyst is stable for a long time. For the adiabatic starting reaction macroporous, alkali-low bodies are needed which are capable of receiving the active catalyst melt from lower depths. In the catalyst bed a mass transport opposing the flow direction of the reaction gas takes place.

42054 **APTIC NO. 63933**

Yamate, Noboru

PHOTOCHEMICAL STUDIES OF AIR POLLUTION (REPORT 1), PHOTOCHEMICAL PRODUCTS BY HYDROCARBONS AND THE MIXTURE OF HYDROCARBONS AND NITROGEN DIOXIDE. *(Taiki osen no kokagaku kenkyu (daippo), tanka suiso oyobi tanka suiso to nisanka chisso kongo gasu no kokagaku seiseibutsu ni tsuite). Text in Japanese. In: Studies on Tokyo Smog. Tokyo Metropolitan Research Inst. for Environmental Protection (Japan), Rept. 3, p. 725-733, March 1974. 9 refs.*

Studies of the photochemical reaction of hydrocarbons and nitrogen oxides in automobile exhaust gases are presented. Methane, propane, 1-butene, 1-3 butadiene, ethylene (all 1000 ppm), and nitrogen dioxide (300 ppm) were used. Hydrocarbon singly or HC and NO2 in mixture were put in 1 liter silica reaction jars and irradiated by xenon or solar radiation. The products were analyzed by infrared spectrophotometry, gas chromatography, carbon monoxide infrared analyzer, and colorimetry. When 1000 ppm of 1-butene was irradiated by the sun for 5 hr, the concentration was reduced to 980 ppm, and when irradiated by xenon, the concentration was reduced to 500 ppm. When the 1-butene-NO2 mixture was irradiated by xenon for 8 hrs, 1-butene disappeared completely. After 1 hr of irradiation, 70 ppm of carbon monoxide, 99 ppm of formaldehyde, and 64 ppm of ethyl nitrate were formed. In 8 hr, CO increased to 300 ppm, formaldehyde to 130 ppm, and ethyl nitrate to 104 ppm. When HC was irradiated singly, methane and propane were stable, but 1,3-butadiene, 1-butene, and ethylene decomposed. When NO2 coexisted, methane and propane reacted slightly, but other species produced a large amount of CO, formaldehyde and alkyl nitrate. These reactions may occur in the atmosphere.

42055 **APTIC NO. 63934**

Yamate, Noboru

PHOTOCHEMICAL STUDIES OF AIR POLLUTION (REPORT 2): IRRADIATION PRODUCTS OF AUTOMOTIVE EXHAUST GASES. *(Taiki osen no kokagaku kenkyu (dai 2-ho), Jidosha haiki gasu no koshosha seiseibutsu ni tsuite). Text in Japanese. In: Studies on Tokyo Smog. Tokyo Metropolitan Research Inst. for Environmental Protection (Japan), Rept. 3, p. 734-741, March 1974. 5 refs.*

Automotive exhaust gas containing a variety of pollutants was irradiated and the components before and after irradiation were compared. Exhaust gas was taken from an idling car into a vacuum silica jar of 1 liter capacity and solar irradiation was applied between 10 am and 2 pm on a bright sunny day. Xenon irradiation was applied for comparison. The components of the gases were analyzed by gas chromatography, infrared spectrophotometry, and colorimetry. The xenon irradiation products analyzed by infrared spectrophotometry showed formation of alkyl nitrate, but there were no other changes, probably due to the limitation of the analyzer. Hydrocarbon composition of exhaust gas is complex; but for the gas chromatography analysis, aliphatic hydrocarbons of C1 to C6 were checked. The total concentration of HC was 400-900 ppm, of which more than 90% was methane, ethane, ethylene, and acetylene. During irradiation, olefin HCs were rapidly reduced, and acetylene and saturated HCs were gradually reduced. When exhaust gas was left in a dark place there was a slight amount of 1,3 butadiene reduction, but no other HC responded. Hydrocarbons (especially olefins) and nitrogen dioxide were reduced, but formaldehyde increased in the photochemical reaction of automotive exhaust gas, and the reaction produced methyl nitrite, ethyl nitrite, methyl nitrate, ethyl nitrate, n-propyl nitrate, isobutyl nitrate, biacetyl and peroxyacetyl nitrate. These reactions of automotive gases occur in the atmosphere.

42056 **APTIC NO. 63936**

Yanagihara, Shigeru

VARIOUS ELEMENTS AFFECTING THE PHOTOCHEMICAL REACTION OF AUTOMOTIVE EXHAUSTS. *(Jidosha haiki no kokagaku hanno ni eikyo suru shoyoso). Text in Japanese. In: Studies on Tokyo Smog. Tokyo Metropolitan Research Inst. for Environmental Protection (Japan), Rept. 3, p. 768-785, March 1974.*

Using a large irradiation chamber, automotive exhaust gas and standard hydrocarbons were irradiated by blacklight to see what factors affected the photochemical reaction processes of the gases. For analyses, long-range infrared spectrophotometry, quantitative and qualitative analyses, gas, chromatography, and colorimetry were used. In the photochemical reaction of hydrocarbons and nitrogen oxides, the HC/NOx ratio and reactivity of HC are important; when HC/NOx increases, the reaction speed increases. In most cases, the increase of HC concentration increases the reaction speed, and the increase of nitric oxide concentration slows down the reaction. The speed is greatly affected by the concentration and activity of HC, and the maximum level of oxidant is also so affected. The maximum level of oxidant is also affected by the initial NOx concentration when HC activity is sufficient. The intensity of ultraviolet radiation affects the reaction speed approximately proportionately, and given the same conditions, the rate of increase of oxidant and its maximum quantity corresponds to the irradiation intensity. The temperature does not affect the reaction much when HC is very active, but when the HC activity is limited, the increase of temperature from 20 C to 35 C will double the reaction speed. Within the 30 to 80% humidity range, the reaction is not affected, but 90% humidity will slow down the photochemical reaction. Generally olefins react very much, alkyl benzene not very much, and paraffins very little.

42057 **APTIC NO. 63537**

Yang, R. T., P. T. Cunningham, W. I. Wilson, and S. A. Johnson

KINETICS OF THE REACTION OF HALF-CALCINED DOLOMITE WITH SULFUR DIOXIDE. *Argonne National Lab., Argonne, Ill., Chemical Engineering Div., Environmental Protection Agency Contract EPA-IAG-0199, 15p., Feb. 1974. 11 refs.*

Initial results on the kinetics of the reaction of half-calcined dolomite (calcium carbonate plus magnesium oxide) with sulfur dioxide are presented as part of a program to develop a fluidized-bed combustor for high sulfur coal. The reaction rate, and hence the extent of the reaction at a given time, is a function of SO2 concentration, with the mechanism and rate-determining step being different depending on whether or not water is present in the reactant gas. The initial reaction rate increases significantly with temperature over the range of 550-850 C, with an Arrhenius plot of the data yielding an apparent activation energy of 7.3 kcal/mol. The value does not point conclusively to a mechanism in which some chemical reaction is rate controlling but is somewhat greater than expected if the reaction is diffusion controlled. Examination of the sulfation of calcined magnesium carbonate and comparison with the results from the half-calcined stone show that the sulfation of MgO is not great and the reaction rate is much less than for the half- calcined stone; nevertheless, the effect is too great to be ignored in any more detailed treatment of the half-calcined results. Results are also shown for the sulfation of fully- calcined stone under the same condition, notwithstanding the absence of carbon dioxide in the reactant gas. Further work is needed to more fully understand the role of water in the sulfation mechanism and to extend the kinetic studies to the reduction and regeneration reactions.

42058 **APTIC NO. 63903**

Yokota, Hisaji, Masataka Sofuku, Yoshiko Kobayashi, Kinji Nakano, Tokiko Tsukada, and Toshio Odaira

RESULTS OF SMOG CHAMBER IRRADIATION EXPERIMENTS. *(Sumoggu chanba ni yoru shosha jikken kekka ni tsuite). Text in Japanese. In: Studies on Tokyo Smog. Tokyo Metropolitan Research Inst. for Environmental Protection (Japan), Rept. 3, p. 242-281, March 1974. 9 refs.*

Smog chamber irradiation experiments were conducted with automotive exhaust gas with a composition similar to atmospheric composition at the time of smog formation. Experimental apparatus, procedures and reaction conditions are described in detail. The light intensity in the chamber fluctuates slightly, but the average intensity is comparable to that of natural light. Contamination of the chamber is greater than in other chambers, and should be taken into account for the evaluation of results. The reaction is greatly affected by the ratio of initial concentrations of hydrocarbon and nitrogen oxides (HC/NOx), and the higher the HC/NOx, the higher the reaction rate and concentration of reaction products. The main reaction products are carbon monoxide, formaldehyde, aliphatic aldehyde, peroxyacetyl nitrate (PAN), ozone, and a small amount of acrolein. Among propylene, toluene and styrene, the PAN concentration was the highest in the case of C3H6. The value of PAN/O3 is 0.2-0.3 in most cases and considerably higher than the environmental value, which is probably due to the difference in conditions (concentration and composition). In the irradiation experiment at idling, the reactivity of C3H6, xylene, and ethyl toluene was higher than that of ethane, ethylene, pentane, C6H5CH3, and ethyl benzene based on the rate of decrease in HC.

1973

42059 **APTIC NO. 64336**

Baczynski, Tadeusz

TECHNOLOGICAL PROBLEMS IN REDUCING THE LEAD CONTENT OF GASOLINE. *(Problemy technologiczne zwiazane z obnizaniem zawartosci olowiu w benzynie). Text in Polish. Nafta (Katowice), 29(9):417-420, 1973.*

The present achievements and problems connected with reduction of the lead content in the gasoline used in motors in the United States are discussed. The refining processes generating isoparaffins for gasolines are presented. Motor vehicles pollute the urban atmosphere with combustion gases containing 54.7 g/km carbon monoxide, 2.6 g/km nitric oxide, 0.5 g/km sulfur oxides, 10.1 g/km incompletely incinerated hydrocarbons, and lead compounds. The lead content in gasoline can be reduced by using isoparaffinic compounds in the production of higher grades of gasoline. The Institute for Petroleum Technology has obtained a 42% fraction containing 95% paraffinic hydrocarbons and 58% gasoline component with an octane number of 84.2. This raw material consists of: 12.5 isopentane, 21.6% pentane, 2.8% cyclopentane, 0.3% 2.2 dimethyl butane, 1.6% 2,3 dimethyl butane, 14.2% 2-methyl pentane, 8.8% 3 methyl pentane, 19.9% n-hexane, 11.0% methyl cyclopentane, 6.3% cyclohexane, and 1.0% benzene. Studies are being conducted in the Soviet Union on obtaining solvents C6 C7 needed in the production of polyethylene, polypropylene, rubber, seals, paints, and lacquers. Selection of oil containing a negligible C5 fraction, can decrease the octane number in the combustion fuel obtained. The octane number of the fuel Isosive process is only 84.2.

42060 **APTIC NO. 63520**

Hauffe, Karl

CATALYSTS FOR OZONE DECOMPOSITION. *(Katalysatoren zur Zerstoerung von Ozon in ozonhaltiger Luft und ozonhaltigen Gasen). Text in German. (Assignee not given.) W. Ger. Pat. Appl. 1,966,535. 12p., April 5, 1973. 3 refs. (7 claims).*

Catalysts suitable for the decomposition of ozone in air and gases are described. The catalysts are composed of trivalent and bivalent nickel oxides, with or without lithium oxide; tetravalent manganese oxide; univalent and/or bivalent copper oxide; cobaltous oxide and tricobalt tetroxide; and silver oxide. These catalysts are applied on alumina hydrate or activated carbon supports, and are used in powder or pellet form, or as sintered porous bodies. Thus, a catalyst may contain 50% nickel oxides, 40% manganous oxide, and 10% 1:1 ratio of monovalent and bivalent copper oxides on an alumina hydrate support at a catalyst-support ratio of 20:80. Such catalysts have a life of at least 2 yr. and decompose ozone up to 0.1 ppm at temperatures above 50 C.

42061 **APTIC NO. 65005**

Hecht, Thomas A., Philip M. Roth, and John H. Seinfeld

MATHEMATICAL SIMULATION OF ATMOSPHERIC PHOTOCHEMICAL REACTIONS: MODEL DEVELOPMENT, VALIDATION, AND APPLICATION (FINAL REPORT). *Systems Applications, Inc., San Rafael, Calif., Environmental Protection Agency Contract 68-02-0580, Task 10, Proj. 26AAD, Program Element A11008, Rept. EPA-650/4-74-011, R73-28, 162p., July 1973. 27 refs.*

NTIS: PB-233 049/AS

Mathematical simulation tasks involving the development, evaluation, exercise, and analysis of kinetic mechanisms for photochemical smog are described. A sensitivity analysis of the simplified Hecht-Seinfeld (HS) mechanism was performed, and the mechanism was then used in the planning of a number of smog simulation experiments for outdoor chamber studies. Major aspects of the studies were the simulation of the chemical dynamics of proposed experiments under conditions varying temperature, light intensity, and ratios. Results of the sensitivity study of the HS mechanism and analysis of kinetic mechanisms demonstrated deficiencies in the HS mechanism. An improved kinetic mechanism was developed which treats the inorganic reactions in substantial detail and the organic reactions in general terms. The kinetic mechanism was formulated to strike a balance between accuracy of prediction and compactness of representation. The results of the initial evaluation of the new mechanism using n-butane/nitrogen oxides, propylene/nitrogen oxides, and n-butane/propylene/nitrogen oxides smog chamber data are included. (Author abstract modified)

42062 **APTIC NO. 64177**

Hidy, G. M.

THEORY OF FORMATION AND PROPERTIES OF PHOTOCHEMICAL AEROSOLS. *Preprint, Battelle Memorial Inst., Seattle, Wash., Seattle Research Center Summer Inst., 57p., 1973. 36 refs. (Presented at the Fundamental Chemical Basis of Reactions in a Polluted Atmosphere Conference, Seattle, Wash., June 18-29, 1973.)*

Aerosols can react in the presence of light in photochemical reactions. Aerosols over urban areas can react to form haze and photochemical smog. These chemical reactions and the physical properties of aerosols are discussed. The most important physical properties of aerosols are particle size, total concentration, surface area/unit volume, volume fraction, mass concentration, and light scattering/extinction coefficient. Aerosol size distributions in urban and nonurban locations in California are discussed. Chemical transformations are concentrated in the 0.1-1.0 micron range. Differences in aerosol size distributions are more sharply contrasted by the second and third moments of size distribution. Data is given on the formation of smog; the growth of particles; the size distribution of aerosols at desert, motor vehicle emission, and sea sites; changes in aerosol concentration caused by irradiation; changes in aerosol size distribution during the day; the relationship between particle size and refractive indices; chemical composition of particulate matter in urban areas; and the relationship between ozone and aerosols. By choosing suitable tracers for material from certain sources, such as lead for automobile exhaust, an inventory of aerosols can be made based on chemistry. Such an inventory is shown for the Los Angeles aerosol. The chemical components of aerosols can vary strongly by day, but the key components are oxygenated carbon compounds, sulfate, ammonium, nitrate, and water. Chemical reactions leading to aerosol precursors are discussed including oxidation of sulfur dioxide to form sulfate, photochemica reactions with SO_2, oxidation of SO_2 absorbed in liquid water droplets, ozone/SO_2/HC reactions, ozone/1-butene reactions, ozone/olefin reactions, and nitrate formation.

42063 **APTIC NO. 64026**

Hopkins, Alfred G., Sheng-yuh Tang, and Chris W. Brown

INFRARED AND RAMAN SPECTRA OF THE LOW TEMPERATURE PRODUCTS FROM DISCHARGED SULFUR DIOXIDE. *J. Am. Chem. Soc., 95(11):3486-3490, May 30, 1973. 18 refs.*

Intermediates in the oxidation of sulfur and sulfur-containing compounds are examined. An investigation of the species produced by subjecting sulfur dioxide and sulfur trioxide to both radiofrequency and microwave electrodeless discharges is presented. The infrared spectra of the products condensed at 20 and 80 K and the Raman spectrum of the products condensed at 80 K are given. Through the infrared and Raman spectra of the condensates the SO_3, S_2O, ozone, sulfur radicals, and a poly (sulfur oxide) were identified. The Raman bands of S_3 indicate that it is a bent molecule, whereas the bands of S_4 suggest that it has a trans structure. Only speculation is possible on the mechanisms for the formation of these compounds in the discharge. One very useful feature of the present experiments is the detection of SO_3 in a mixture by measuring the infrared spectrum of the mixture condensed at liquid nitrogen temperature. The SO_3 is directly identified.

42064 **APTIC NO. 63633**

Levy, Arthur

THE PHOTOCHEMICAL SMOG REACTIVITY OF ORGANIC SOLVENTS. *Advan. Chem. Ser., 124(12):70-94, 1973. 25 refs.*

The chemical solvent industry is greatly affected by current air pollution regulations on local, state, and national levels. Current control laws are based in large part on Los Angeles Rule 66 which ranks specific solvents and classes of solvents according to their potential smog-forming capability. A number of studies have been conducted over the past several years that tried to define the relationship between organic solvents and photochemical smog production. These studies are reviewed. Solvents are ranked according to various photochemical smog parameters, taking into account many of the conditions (differences in chambers, concentration, and light intensity) under which the particular studies were conducted. The solvents are ranked based on the rate of photooxidation of nitric oxide to nitrogen dioxide, the oxidant production, the eye-response time, and the formaldehyde formation. The effect of other atmospheric influences on smog, such as sulfur dioxide, and relative humidity, are also mentioned. It is possible to reformulate solvents to produce less reactive solvents. The cost effectiveness of a substitution for a solvent blend is mentioned. (Author abstract modified)

42065 **APTIC NO. 63435**

Lin, C. L. and W. B. DeMore

SINGLET ATOMIC OXYGEN O(1D) PRODUCTION IN OZONE PHOTOLYSIS NEAR 310 NM. *California Inst. of Technology, Pasadena, Jet Propulsion Lab., National*

Aeronautics and Space Administration Contract NAS 7-100, TMn33-635, NASA-CR-1222206, 11p., July 15, 1973. 8 refs.

NTIS: N73-27311

Relative quantum yields of singlet atomic oxygen (O(1D)) production in ozone photolysis from 275 to 334 nm were determined in the gas phase at 233 K in a laboratory experiment. The O(1D) was monitored by means of its reaction with isobutane to form isobutyl alcohol. The light source was a high pressure mercury lamp combined with a monochromator, with a bandwidth of 1.6 nm. The results showed a constant relative quantum yield of singlet atomic oxygen below 300 nm, which was taken as unity on the basis of previous work. There was a very sharp fall-off in quantum yield which is centered around 308 nm. At 313 nm, the quantum yield of O(1D) was not greater than 0.1. (Author abstract modified)

42066 **APTIC NO. 63999**

Liu, C. Y. and K. G. Agopian

A MODEL FOR FLUID MECHANICAL STUDIES OF AIR POLLUTION. *Society of Engineering Science, Pollut. Eng. Sci. Solutions, Proc. Int. Meet. Soc. Eng. Sci., 1st, Tel Aviv, Israel, 1972, p. 77-94, 1973. 20 refs. (June 12-17.)*

A chemical model designed for fluid mechanical studies of pollutant distribution in the atmosphere is presented. The seven-step kinetic mechanism consists of different rate constants and stoichiometric coefficients for various hydrocarbons. It is verified against several sets of experiments. The kinetic mechanism is adopted to predict pollutant time history in static and convective conditions simulating containments distribution in an urban (Los Angeles) basin. The model is also used to construct simple scaling laws and to examine the efficiency of various automobile engines in reducing pollutant levels. The static model gave good agreement for hydrocarbons and nitrogen oxide levels but overestimated the ozone level. The convective version gave good agreement for the O3 level, while underestimating the HC and NOx levels. The model is presently perhaps too simple to describe all relevant chemical species in the lower atmosphere, yet it identifies the importance of the problem as a chemical one. (Author abstract modified)

42067 **APTIC NO. 65932**

Morgan, W. L. and R. J. Farrauto

ACTIVE SITES ON A COPPER CHROMITE CATALYST. *J. Catalysis, 31(1):140-142, Oct. 1973. 8 refs.*

The active sites on a copper chromite exhaust control catalyst were investigated. Oxygen and carbon monoxide were alternately added to the catalyst at 60 C, which is below its bulk reduction temperature. The carbon dioxide produced was monitored as a function of each constituent adsorbed. Active site concentration is determined from the actual catalytic reaction allowing one to differentiate active sites from adsorption sites. The BET nitrogen surface area is 2.7 sq m/g catalyst, so the number of O2 atoms adsorbed (or available active sites) per 100 sq A is 1.89. The sulfur dioxide present in commercial fuels adsorbs preferentially on these would be active sites seriously retarding initial conversion.

42068 **APTIC NO. 63807**

Omura, Hirohisa, Masakazu Tsutsumi, Koichi Ariyoshi, Ryuichi Ishikita, and Masatoshi Morooka

VARIATION OF ABSORPTION SPECTRA OF BASES, NUCLEOSIDES AND NUCLEOTIDES BY OZONATION. *(Ozon shori ni yoru enki, nukureoshido oyobi nukure ochido no kyushu supekutoru no nendo). Text in Japanese. Kyushu Daigaku Nogakubu Gakugei Zasshi (Sci. Bull. Fac. Agric. Kyushu Univ.), 27(3-4):211-220, July 1973. 4 refs.*

Adenine, guanine, thymine, cytosine, uracil, their nucleosides and nucleotides were treated with ozone at pH 5, 7, or 9 and their absorption spectra estimated at different ozonation times. The spectra varied depending on pH, except for adenine and adenosine at pH 5, indicating the reaction with ozone. Some differences in the variation were also observed among bases, nucleosides, and nucleotides.

42069 **APTIC NO. 63984**

Ooki, S., J. Happel, and A. Leon

REDUCTION OF SO2 BY CO OVER OXIDE CATALYSTS. *(Sankabutsu shokubai jo niokeru SO2 no CO niyoru Kangen). Text in Japanese. Preprint, Japan Chemical Society, Tokyo, p. 142-143, 1973. 1 ref. (Presented at the Symposium on Catalysis, 33rd, Hiroshima, Japan, Oct. 10-11, 1973, Paper 1X13.)*

Catalysts mainly consisting of LaTiO3 are very stable and selectively promote, at a considerably high conversion rate, the reaction of 2 moles of carbon monoxide and 1 mole of SO producing 2 moles of carbon dioxide and 1 mole of sulfur. Hydroxides of lanthanum and titanium were coprecipitated from lanthanum nitrate and titanium tetrachloride and calcined at 930 C for 20 hr to produce LaTiO3 having a specific surface area of 12 to 15 sq m/g. The effect of time on catalytic activity showed longer life time at a larger atomic ratio of La to Ti and at a larger CO/sulfur dioxide ratio, but at the same time more CO was formed. When LaTiO3 was used alone, a small amount of water contained in the reaction gas was found to completely deactivate the catalyst. However, an addition of small amount of alkaline earth metal or alumina catalyst counteracts the effect of water. As a side reaction, the water gas shift reaction took place on the catalyst and was accompanied by the formation of hydrogen sulfide. Nevertheless, the formation of carbonyl sulfide and H2S was very small over this catalyst compared with the Surinam red mud catalyst. The calcination atmosphere largely affects the catalytic activity and calcination of catalyst in a reducing atmosphere is recommended.

42070 **APTIC NO. 64104**

Raabe, Otto G., Jerry E. Bennick, Max E. Light, Charles H. Hobbs, Randi L. Thomas, and Marvin I. Tillery

AN IMPROVED APPARATUS FROM ACUTE INHALATION EXPOSURE OF RODENTS TO RADIOACTIVE AEROSOLS. *Toxicol. Appl. Pharmacol., vol. 26:264-273, 1973. 11 refs.*

A new apparatus for simultaneously exposing up to 88 rodents to radioactive aerosols for periods up to 1 hr is described. The animals are held in the apparatus in specially designed tubes with a small hole at the head end, and the aerosol passes through a small hole in front of each animal s head so that primarily the nasal area of each animal is continuously exposed to a fresh supply of the radioactive aerosol. Provision is made for aerosol generation, for heat treatment of the aerosol if necessary, and for sampling for aerosol characterization with a cascade impactor, a filter, and an electrostatic precipitator. Tests of the operating characteristics of the apparatus performed with nonradioactive aerosols of uranine showed relative consistency of the air concentrations and particle size distributions of aerosols at the exposure ports and the sampling port. Test exposures of Syrian hamsters to both monodisperse and polydisperse aerosols of fused clay particles labeled with cesium(137) yielded satisfactorily uniform average whole body burdens and average lung burdens for animals in each tier of exposure ports in the apparatus. Individual variability of deposition among animals was within the expected range with a coefficient of variation of about 25% for the lung burdens. (Author abstract)

42071 **APTIC NO. 64014**

Sehmel, George A.

PARTICLE COLLECTION EFFICIENCIES ON CYLINDRICAL WIRES. *Society of Engineering Science, Pollut. Eng. Sci. Solutions, Proc. Int. Meet. Soc. Eng. Sci., 1st, Tel Aviv, Israel, 1972, p. 564-571, 1973. 11 refs. (June 12-17.)*

Particle mass transport and deposition mechanisms of eddy diffusion, particle inertia, and lift forces are described by effective eddy diffusion coefficiences directed toward the deposition surface. The turbulent deposition of aerosol particles from an air stream onto a surface is one means by which airborne particulates are removed from the polluted atmosphere. Of principal concern in deposition is the eddy diffusion coefficient in the region very close to the surface in which the turbulence scale and intensity decrease rapidly as the surface is approached. These eddy diffusion coefficients are predicted from particle deposition velocity measurements through the use of a model which describes particle deposition in terms of eddy diffusion, Brownian diffusion, and the terminal settling velocity. Experimental and theoretical results are compared. (Author abstract modified)

42072 **APTIC NO. 63581**

Unland, Mark L.

ISOCYANATE INTERMEDIATES IN THE REACTION OF NO AND CO OVER NOBLE METAL CATALYSTS. *J. Catalysis, vol. 31:459-465, 1973. 14 refs.*

A comparative study is made of the infrared spectra of reaction intermediates and chemisorbed species during the reaction of nitric oxide plus carbon monoxide over platinum, palladium, rhodium, iridium, and ruthenium-on-alumina catalysts at elevated temperatures. A strong band which is assigned to a surface isocyanate species is found in the 2260-2270/cm region on all the noble metals except Ru where the band is either quite weak or entirely absent. The weakness of the band on Ru/Al_2O_3 seems to correlate with its unique low ammonia-forming properties during nitrogen oxides removal from automobile exhaust. Hydrolysis of the surface isocyanate species provides a pathway to NH_3 which does not involve reduction of NO directly with hydrogen already present in the exhaust stream or generated via a water-gas shift mechanism. No assessment of the relative importance of this mechanism with respect to other mechanisms for ammonia formation in actual automobile exhaust can be made for the present results. Sulfur poisoning of Rh and Ru catalysts is observed to inhibit the formation of the isocyanate species; the poisoning, however, is temporary, and the NCO sites can be regenerated by oxidation treatment. (Author abstract modified)

1972

42073 **APTIC NO. 64199**

Fisher, Edward R., Ralph H. Kummler, Richard Marriott, and Peter K. Rol

STUDIES OF ATMOSPHERIC PROCESSES. *Wayne State Univ., Detroit, Mich., Research Inst. for Engineering Sciences, Air Force Contract F19628-72-C-0007, Proj. 8692, Program Code 1E40, ARPA Order 1856, Semi-Annual Technical Rept. 3, AFCRL-TR-73-0287, 61p., Dec. 15, 1972. 35 refs.*

NTIS, DDC: AD 769961

Studies involving infrared chemiluminescence from oxygen atom attack on ethylene in a discharge-flow tube system, theoretical determination of vibrational excitation of molecules, and molecular beam experiments aimed at determining the interaction potential for plume species are presented. Chemical reactions are specified which are responsible for the 2.7 micron emission from oxygen atom attack on ethylene under conditions of low ethylene concentrations and excess oxygen atoms which favor the production of vibrationally excited hydroxy species at total pressures of about 1 torr. Inelastic cross sections are tabulated for carbon monoxide-carbon monoxide collisions at total system energy of 1.5 eV. The observation of radiation associated with the transition of a product from an elevated quantum state to a lower state provides information regarding the fundamental chemical kinetics of the reaction and provides the opportunity to assess the presence of one or both of the reactant partners in an unknown mixture of reactant gases. This capability is of considerable interest in air pollution monitoring and is applicable to both local and remote monitoring of exhaust gases in an oxygen atom environment.

42074 **APTIC NO. 63531**

Hanna, G. Frederick

ODOR CLASSIFICATION OF ORGANIC CHEMICALS. *Inst. of Advanced Sanitation Research, International, Prog. Hazardous Chem. Handl. Disposal, 3rd, Proc. Symp., Indianapolis, Ind., 1972, p. 187-198. 19 refs.*

The odor classification of organic chemicals is presented. The original odor classification included nine general classes with two or more subdivisions in each: etheral, aromatic, balsamic or fragrant, ambrosial, allicaceous, empyreumatic, caprilic, repulsive, and nauseating or fetid. This was modified in favor of an olfactory prism with six groups of odor characteristics which could be visualized as the six apices of the prism: spicy, flowery, fruity, resinous, burnt, and foul. There are numerous factors which contribute to the odor as it is perceived. Chemical constituents, spatial arrangements of the atoms within the molecules, reactive groups, and degree of dilution all affect the response of the individual to the chemical information being transmitted. Recent reports show major changes or loss of odor upon repurification of the chemicals tested. The odors Y-nonalactone and Y-undecalactone are altered olfactorily by repeated repurification. A possible statistical and quantum mechanics approach to define the distribution of the odor molecules between the air and the sensing surface is given. In principle, the developed relationships include all the factors and interactions of the various odor theories. Size, shape, functional groups, and intermolecular interactions, such as hydrogen bonding, dipole, quadripole, and charge-transfer interactions are all included. The rotational partition function in the gas-phase is shape dependent, reflecting the spatial geometry and flexibility of the molecule in air and as an adsorbed species. Until the limits of the various parameters are defined more precisely, these must be exceptions to each grouping which appear to be contradictions of the classification rules.

42075 **APTIC NO. 63994**

AIRBORNE CHEMICALS. *In: Patterns and Perspectives in Environmental Science. p. 329-338, 1972.*

GPO

Chemical contaminants in the atmosphere and their effects upon the environment are studied. The distinction between a harmful contaminant and a pollutant may be a narrow one. Volcanic ash and desert sandstorms are not classed as pollutants. Air may be rendered harmful to life, not by contamination, but by the absence of oxygen. There exists an enormous complex of processes which maintain the atmosphere at its present composition. A substantial increase or decrease in generation of contaminants will be rapidly counteracted, at least in part, by a corresponding change in rate of removal. All forms of life release wastes to the environment. Wastes by definition are in some degree toxic to the organisms that excrete them. No acceptable degree of control is imminent for the human population. Analytical methods are being developed, including the nephelometer that rapidly assesses local atmospheric haziness and also makes possible laboratory experiments on modification. Verifiable standards need to be established for precision, specificity, and accuracy in measuring pollutants at concentrations as low as 1 ppb of air. Studies of urban pollution, analytical methods, and laboratory models of reactions producing, altering, and removing contaminants are three areas of atmospheric chemistry that require immediate attention. A physical and mathematical basis of air quality models is provided, along with performance of the models, using the Gaussian-plume formula. The major theoretical deficiency is the inability of any model based on Gaussian-type formulae to handle the problem of chemically reacting pollutants and the production in situ of secondary pollutants, circumstances typical of the production of Los Angeles-type photochemical smog.

1971

42076 **APTIC NO. 64211**

Heemstra, Raymond J.

A CONTROLLED-ATMOSPHERE PLASMA ARC FOR EMISSION SPECTROGRAPHY OF NONMETAL ELEMENTS. *Develop. Appl. Spectr., vol. 9:199-216, 1971. 14 refs. (Presented at the Annual Mid-America Spectroscopy Symposium, 21st, Chicago, Ill., June 2-5, 1970.)*

To estimate the weight-percents of certain nonmetal elements in organic compounds found in petroleum reservoirs, a controlled- atmosphere plasma arc which effectively excludes air from the plasma was designed. Selected organic compounds that contained nonmetal elements were estimated from the diatomic spectral bands produced; results were reasonably accurate. Analytical working curves were prepared for nitrogen in the range from 15 to 450 micrograms for 100-milligram samples using the analytical carbon-nitrogen band at 3883 A and the internal standard carbon- carbon band at 3607 A. Curves also were prepared for hydrogen, sulfur, and oxygen that had limited sensitivity to detection. Another indicated application of this plasma arc is for characterization of high-boiling petroelum fractions is liquid chromatographic effluents. In an analysis of crude oil, sulfur and nitrogen concentrations were determined. The rates at which diatomic species are produced and destroyed directly influence the intensity of each corresponding band spectrum. Factors affecting the ratio of C-N to C-C band intensities are flow rate, rate of production and dissociation of diatomic species, solvent composition, and plasma characteristics. (Author abstract modified)

1969

42077 **APTIC NO. 64292**

Petryanov, I. V., B. I. Ogorodnikov, and L. A. Zimina

STUDY OF THE RESISTANCE OF FIBROUS FILTERING MATERIALS IN RAREFIED AIR. *Main Administration of the Hydrometeorological Service (U.S.S.R.), Inst. of Experimental Meteorology, Proc. All-Union Conf. Nucl. Meteorol., Obninsk, U.S.S.R., 1969, p. 353- 357. 7 refs. (June 23-28.) Translated from Russian. Israel Program of Scientific Translations, Jerusalem, 1974.*

NTIS: TT 7450011

The resistance of fibrous FP filtering materials in a flow of rarefied air is studied. The material resistance delta p decreases with increasing length lambda of the mean free path of the gas molecules, because the gas flow glides along the filter fibers, and at normal atmospheric pressure the resistance of almost all FP materials is already lower than its maximum. For FPP-5, LFS-2, and FPP-15 materials, which consist of ultrafine fibers, the loss of resistnace of 10-20%. Higher compaction beta leads to a slight additional drop in resistance from the maximum for the given compaction. The resistance of FP materials under gliding flow conditions is computed by the formula delta p equals 4beta n vh/a sub hydr squared(-0,5 ln beta - 0.5 + lambda/a sub vis where n is the air viscosity, v is the linear velocity, h is the filter thickness, and sub hydr and a sub vis are the hydrodynamic and mean visual fiber radii, respectively. A correction for gliding is recommended.when lambda/alpha sub vis is greater than 0.005. (Author abstract)

42078 **APTIC NO. 64293**

Redkin, Y. N.

PRELIMINARY DATA ON THE MEASUREMENT OF THE ATMOSPHERIC AEROSOL CHARACTERISTICS WITH A CENTRIFUGAL SPECTROMETER. *Main Administration of the Hydrometeorological Service (U.S.S.R.), Inst. of Experimental Meteorology, Proc. All-Union Conf. Nucl. Meteorol., Obninsk, U.S.S.R., 1969, p. 259-272. 14 refs. (June 23-28.) Translated from Russian. Israel Program of Scientific Translations Jerusalem, 1974.*

NTIS: TT 7450011

An aerosol spectrometer which makes it possible to obtain continuous spectra of particles from Stokes radii between 0.4 and 10 micron is described. A relationship phi equals phi(R subS) whose log-log plot for particles of R sub S is equal to or greater than 10 to the minus 4 power cm is almost a straight line is derived from the equation of particle motion in a viscous space for a rotating system of coordinates. Here phi is the angle of particle deviation from a radius passing through the point from which the particle started moving. The spectrometer model was built as a hollow, rotating steel disk, through the axis of which aerosol is pumped. Owing to centrifugal sedimentation, part of the dust penetrates special slots to form a pencil of rays splitting more and more as the particles move away from the axis of rotation. The coarser the particle, the larger the angle of its deviation. A theoretical evaluation of the efficiency of this device showed it to depend very little on particle size at R sub S greater than 10 to the minus 4 cm (being 65 to 70%), as confirmed by the results of a calibration using puffball and lycopodium spores. The distribution of alpha-activity of particles R subS equals 0.4 times 10 to the minus four cm varies little and is almost only a hundredth of the specific overall alpha-activity measured on an FPP filter. (Author abstract)

1966

42079 **APTIC NO. 64091**

Sterbis, Eugene Edward

DECOMPOSITION OF NITROUS OXIDE CATALYZED BY NICKEL OXIDE. *Colorado Univ., Dept. of Chemical Engineering, Thesis (M.S.), Colorado Univ., 1966, 69p. 25 refs.*

The results, correlations, and interpretation of an experimental study of the rate of decomposition of nitrous oxide on a nickel oxide catalyst are presented. The constants of the correlations are interpreted in the light of Langmuir-Hinshelwood mechanisms. The experimental tests were conducted in a reactor that approximated an ideal back-mix reactor. The minimum conversions of nitrous oxide were 20%. The reactor was operated at atmospheric pressure over a temperature range of 300 to 400 C. The input to the reactor was pure N2O at flows from 50 to 130 cc/min at 0.82 atm and 24C. The analysis of the product stream was performed using a thermistor-type thermal conductivity cell. The rate of decomposition of N2O was highly dependent on the amount of oxygen adsorbed on the surface. The rate in the first 8 hr of a run corresponded to the adsorption of oxygen being the rate controlling step. A first-order rate law applied if the catalyst surface was sparsely covered with oxygen. For nickel oxide, saturation coverage for adsorbed oxygen was 1% of the total catalyst surface area. (Author abstract modified)

1962

42080 **APTIC NO. 63507**

Avy, A. P.

THE PROBLEM OF THE GENERATION OF HOMODISPERSE AEROSOLS FOR TESTING FILTER MATERIALS. *(Le probleme de la realisation d aerosols homodisperses pour l essai des matieres filtrantes). Text in French. Czechoslovak Academy of Sciences, Aerosols, Phys. Chem. Appl., Proc. Nat. Conf., 1st, Liblice, Czechoslovakia, 1962, p. 629-643. (Oct. 8-13.)*

Experiments and theoretical considerations on the obtaining fine, homodisperse aerosols for testing aerosol filter materials are described. Vaporization and condensation methods were chosen for aerosol generation; and an overabundance of condensation nuclei, rapid dilution of the aerosol just formed to prevent agglomeration, and a certain degree of supersaturation for condensation in a given size range were required. The experiments were conducted with indigo aerosol because indigo forms molecular crystals, and shows no tendency of agglomeration. A modified version of La Mer s aerosol generator with progressive cooling of the hot air containig indigo vapor was used for the experiments. The aerosol particles obtained ranged from 100 to 3550 A, i.e., no monodisperse aerosol was obtained. Further tentative experiments for the obtainment of amorphous or crystalline aerosols or anthraquinone and phthalic anhydride revealed the impossibility to obtain aerosols finer than 100 A. A given substance with a well-defined monodisperse crystal form can not form such monodisperse aerosol beyond a well-defined particle size, and this preferential particle size is conditioned by a state of equilibrium in the crystal lattice and a certain degree of turbulence in the surrounding medium.

42081 **APTIC NO. 63482**

Davies, C. N.

THE ASPIRATION OF HEAVY AIRBORNE PARTICLES INTO A POINT SINK. *Czechoslovak Academy of Sciences, Aerosols, Phys. Chem. Appl., Proc. Nat. Conf., 1st. Liblice, Czechoslovakia, 1962, p. 131-138. 2 refs. (Oct. 8-13.)*

Equations are given representing the motion of heavy airborne particles sucked into a tube or a point sink with the motion due entirely to suction. Four situations can occur: particles move with the air, small particles, low rate of suction; particles settle with appreciable speed but have negligible inertia, low rate of suction; particles have negligible settling speed but appreciable inertia, small particles; and particle settling speed and inertia have to be taken into account. The motion of different size particles is discussed.

42082 **APTIC NO. 63489**

Deryaguin, B. V., S. P. Bakanov, and J. I. Rabinovich

THEORY OF THERMOPHORESIS OF AEROSOL PARTICLES AND ITS VERIFICATION. *Czechoslovak Academy of Sciences, Aerosols, Phys. Chem. Appl., Proc. Nat. Conf., 1st Liblice, Czechoslovakia, 1962, p. 197-205. 15 refs. (Oct. 8-13.)*

The elaboration of an exact theory of thermophoresis for the general case of particles with an arbitrary radius involves great diffuculties and can hardly lead to simple and practically applicable equations. Therefore, simpler, limiting cases for particles with a radius R, smaller or larger than the free path of the gas molecules, are considered. In the first case with R considerably smaller than the free path, thermophoresis and diffusiophoresis are treated quantitatively as a special case of the kinetic theory of inhomogeneous gases. More complicated conditions are encountered in the case of large aerosol particles, since the velocity distribution of the molecules impinging on the surface of the particle changes in a more complicated way than the volume distribution. The developmen of a correct theory of thermophoresis based on application of thermodynamics considreing various cases is described.

42083 **APTIC NO. 63488**

Fuchs, N. A.

TRANSPORT PHENOMENA IN AEROSOLS WITH PARTICLE SIZE COMPARABLE WITH THE MEAN FREE PATH OF THE GAS MOLECULES. *Czechoslovak Academy of Sciences, Aerosols, Phys, Chem. Appl., Proc. Nat. Conf., 1st, Liblice, Czechoslovakia, 1962, p. 195. (Oct. 8-13.)*

The phenomena of jumps of velocity, temperature, and concentration at the boundary between condensed and gas phases are connected with transport of impulse, heat, and mass from the gas medium to aerosol particles; resistance of the medium to the motion of particles; thermophoresis and photophoresis; temperature changes of the particles in a warmer and colder medium; evapration and condensation growth of the particles; and adsorption and desorption The theory of these jumps assumes that the gradient of velocity has a constant value up to the boundary itself and the transport of the corresponding quantity is calculated according to the equation of hydrodynamics, theory of thermal conductivity, or diffusion also up to the wall. A means of obtaining approximate equations for the mobility, evaporation rate, etc., of the particles is described. Calculation methods yield correct results in the case of a flat wall or of an aerosol particle with radius r which is much greater than lambda (the mean free path of gas molecules).

42084 **APTIC NO. 63480**

Gucker, Frank T., Robert L. Rowell, and Grace Chiu

A STUDY OF INTENSITY FUNCTIONS FOR DIELECTRIC SPHERES CALCULATED FROM THE MIE THEORY: TABLE OF ANGULAR FUNCTIONS PI AND T SUB N OF ORDERS 1 TO 43 AT 1 DEGREE INTERVALS. *Czechoslovak Academy of Sciences, Aerosols, Phys. Chem. Appl., Proc. Nat. Conf, 1st Liblice, Czechoslovakia, 1962, p. 59-113. 18 refs. (Oct. 8-13.)*

The Mie theory is used to calculate scattering from dielectric spheres of refractive index m equals 1.486, over the range of particle size parameter alpha equals 0.1(0.1) 30.0 and scattering angle theta equals 0(1) 180 degrees. These results were compared with calculations from the limiting series expansion at small alpha, and from a new expression for angular dependence based upon a cosine power series expansion of the classical Mie angular functions. Double-precision calculations reproduce the classical intensity calculations to + or - 1% or better, and the position of the maxima and minima in the scattering diagrams to 0.1 deg over th whole range of alpha and theta. Single precision calculations reproduce the classical intensity functions to + or - 2% over an angular range around 90 deg decreasing from + or - 90 deg at alpha equals 15 to + or - 20 at alpha equals 30, and the positions of maxima and minima in the scattering diagrams to 0.1 deg over the same range. Results are shown on intensity-contour diagrams and extreme-value diagrams in the alpha-theta plane, on which the maximum and minimum lines appear and disappear in pairs at the same value of alpha and almost always at the same point on the alpha-theta diagram. The nature and use of these diagrams are discussed. Tables of the Mie functions Ps sub n (cosine theta) and T sub n (cosine theta) of orders 1 to 43 are given to 6 decimal places at 1-degree intervals from 0 to 180 degrees. Auxiliary coefficients, for calculating the coefficients of the cosine power series from the quantities a sub n and b sub n of the classical Mie theory, are tabulated to eight figures, suitable for single- precision calculations. (Author abstract)

42085 **APTIC NO. 63495**

Kaischew, R. and B. Mutaftschiew

THE THERMODYNAMICS OF NUCLEATION IN SMALL DROPLETS. *(Zur Thermodynamik der Kristallkeimbildung in kleinen Tropfen). Text in German. Czechoslovak Academy of Sciences, Aerosols, Phys. Chem Appl., Proc. Nat. Conf., 1st. Liblice, Czechoslovakia, 1962, p. 293-296. 2 refs. (Oct. 8-13.)*

A theoretical study of the thermodynamics of the nucleation (freezing) of small droplets in melts of infinite size is presented. The energy required for nucleation in a small droplet can be determined by the Gibbs thermodynamic method taking the changes in the radii, specific volumes, and specific surface energies which occur in the course of nucleation into account. In cases when the specific volume of the droplet decreases during freezing, the energy of nucleation is smaller in the individual droplet than is in the entire melt, due to the reduction of the droplet surface. When the droplet radius is unaltered, nucleation energy increases proportionally to the decrease in cooling. Possible changes in the freezing temperature of atmospheric aerosols are conditioned by the size of the droplets.

42086 **APTIC NO. 63484**

Pantschev, S.

THE MOTION OF AEROSOL PARTICLES IN A TURBULENT FLOW. *(Mouvement de partcules d aerosols dans un courant turbulent). Text in French. Czechoslovak Academy of Sciences, Aerosols, Phys. Chem. Appl., Proc. Nat. Conf., 1st, Liblice, Czechoslovakia, 1962, p. 149-152. 4 refs. (Oct. 8-13.)*

A mathematical description is given of the motion of Stokes spherical particles of permanent mass in an isotropic stationary homogeneous local flow, assuming negligible gravitation. A comparison of the velocities of turbulent motion with free fall velocity shows that turbulent motion velocities, both at soil surface and in clouds, may equal and even exceed gravitation. This fact is chiefly responsible for the decisive role of the turbulent coagulation of aerosols.

42087 **APTIC NO. 63496**

Pantschev, S.

THE FREE FALL VELOCITY OF AEROSOL PARTICLES OF VARIABLE MASS. *(Vitesse de la chute libre de particules d aerosols a massa variable). Text in French. Czechoslovak Academy of Sciences, Aerosols, Phys. Chem. Appl., Proc. Nat. Conf., 1st. Liblice, Czechoslovakia, 1962, p. 297-300. 3 refs. (Oct. 8-13.)*

The free fall of aerosol particles with variable mass is described mathematically. The droplets are evaporating or condensing during free fall, and the time required for the particles to evaporate is described by a formula. The formula obtained for the free fall of such particles is Stokes formula incorporating a correction factor.

42088 **APTIC NO. 63491**

Prokhorov, P. S. and L. F. Leonov

MEASUREMENT OF LONG RANGE DIFFUSION FORCES BETWEEN DROPS AND NONVOLATILE PARTICLE. *Czechoslovak Academy of Sciences, Aerosols, Phys, Chem. Appl., Proc. Nat. Conf., 1st, Liblice, Czechoslovakia, 1962, p. 221-222. (Oct. 8-13.)*

A means of measuring the diffusion forces between water drops and non-volatile particles is described in order to estimate the influence of diffusion forces acting at a great distance between the drops and solid particles. Interest arises in consideration of the sterilization of walls of rooms be means of liquid insecticides, and in the abatement of agricultural pests, where liquid insecticides are used , and particularly in the study of the factors influencing the coagulation of cloud drops for obtaining a precise value of the sedimentation coefficient. Measurement of the diffusion forces between water drops and non-volatile particles was carried out using a torsion balance with a vertical elastic suspender and horizontal beam provided at the end of which is a glass silver-coated bead of 1 mm diameter. At 4 and 0% humidity of the medium, the size of the diffusion forces is determined as a function of the distance. The magnitude of the forces is indirectly proportional to the square of the distance within the limits 12 - 5 mm which fully corresponds to the theoretical calculations for an analogous case. At the further approximation of the drops this dependence is no longer valid and the forces increase at a slower rate.

42089 **APTIC NO. 63517**

Roeher, O. and W. Steglich

ULTRASONIC AEROSOL GENERATORS FOR GROUP AND INDIVIDUAL THERAPY. *(Ultraschall-Aerosolgeraete fuer Raum- und Einzelinhalation). Text in German. Czechoslovak Academy of Sciences, Aerosols, Phys. Chem. Appl., Proc. Nat. Conf., 1st, Liblice, Czechoslovakia, 1962, p. 859-864. (Oct. 8-13.)*

The advantages of ultrasonic aerosol generators used in East Germany for group and individual therapy are presented. The ultrasonic aerosol generators, operating at a frequency of about 2,500,000 c/s, and suitable for the atomization of low-viscosity liquids and solutions with low surface tension, generate aerosols in which the majority of the particles are smaller than 5 micron, which means that the drug used for the therapy is practically quantitatively respirable. Conventional aerosol generators which provide 80-90% of the below-8 micron-fraction generate aerosols of which only a small fraction is respirable.

42090 **APTIC NO. 63492**

Smolik, J.

ON THE PROBLEM OF DEPOSITION IN THE DEAD-WATER SPACE. *(Zur Frage der Ansatzbildung im Totwasserraum). Text in German. Czechoslovak Academy of Sciences, Aerosols, Phys. Chem. Appl., Proc. Nat. Conf., 1st, Liblice, Czechoslovakia, 1962, p. 227-235. 7 refs. (Oct. 8-13.)*

A theoretical and experimental study of the deposition of dust particles in dead spaces behind obstacles is described. The force tending to release such deposited particles is determined by the distribution of the tangential stress, and it increases on both sides of the stem point on the separation surface. For small particles, the separating force is proportional to the tangential stress, and deposition occurs in a site in which this force is greater than the adhesion. With weak adhesion, deposition occurs in a narrow strip only, with the center of the deposition lying approximately in the stem point of the separation surface.

1954

42091 **APTIC NO. 64169**

Werle, D. K.

THE FORMATION OF METALLIC AEROSOLS. *Illinois Inst. of Tech., Chicago, Armour Research Foundation, Air Force Cambridge Research Center Contract AF 19(122)-472, ARF Proj. C-022, Sci. Rept. 17, 37p., Sept. 23, 1954. 3 refs.*

DDC: AD 53468

Metallic aerosols were made using a nichrome resistance furnace at 1000 C, a graphite resistance furnace at 2200 C, a tungsten filament at 3000 C, and exploding wires at over 5000 C in a laboratory investigation of metal aerosol formation. Particle size was very dependent on the kind and amount of nuclei present. Cadmium vapor condenses readily on silver iodide nuclei and results in near monodisperse aerosols at high nuclei concentration; at low nuclei concentrations, the aerosol particles were larger and fewer in number. Sodium chloride was comparatively ineffective as a nucleating agent for cadmium. Small amounts of oxygen and water vapor (1-3%) present during the formation of cadmium and zinc aerosols hindered the growth of large particles, especially in the case of zinc; the greater the tendency to oxidize, the smaller the resulting particle size. A similar result was observed with metals that tend to react with nitrogen, for example, magnesium and aluminum. The largest particles resulted when the vapor concentration was high and consisted of a metal not easily oxidized such as cadmium or copper. Aerosols made by exploding wires electrically resulted in dense, highly agglomerated aerosols. Nichrome, silver, and copper apparently produced the largest particles of the metals tested. Metals such as tungsten, iron, and aluminum, when exploded in air, resulted in a fine, fluffy, agglomerated aerosol. Scavenging of metallic aerosols by glass beads and Arizona road test dust appeared to take place readily in all cases, and the effectiveness of the scavenging seemed to be higher for these aerosols having the larger particles present. The less reactive metals when condensed from vapor in air or in nitroge probably resulted in aerosols having larger particles than those produced from metals that are easily oxidized, such as magnesium, aluminum, and iron. (Author abstract modified)

EFFECTS-HUMAN HEALTH

1974

42092 **APTIC NO. 66044**

Cecilioni, V. A.

FURTHER OBSERVATIONS ON CANCER IN A STEEL CITY. *Fluoride, 7(3):153-165, July 1974. 9 refs. (Presented at the Conference of I.S.F.R., 5th, Annual, April 8-11, 1973.)*

The incidence of cancer in the steel city of Hamilton (Ontario) was investigated during 1969-1970. The death rate from cancer in Hamilton was higher than in the less industrialized city of Ottawa. The highest rate (65 per 100,000) occurred in the proximity of the steel mills, compared with the death rates (23 and 12 per 100,000) farther distant. Continuous monitoring in the industrial area disclosed that the levels of carbon monoxide, fluoride, lead, nitrogen oxides, sulfur dioxide, and suspended particulates increased to 15 times above the average of the province of Ontario. In 1971-1972 the atmospheric fluoride levels were up to 20 times higher than the average value for Ontario as a whole which is 40 mgm F/100 sq cm/30 days. Admission records at two large Hamilton Hospitals showed a close correlation between respiratory disease and the daily pollution index. (Author abstract modified)

42093 **APTIC NO. 63697**

Cherepov, Y. M.

METHOD OF STUDYING THE NON-SPECIFIC MORBIDITY IN CHILDREN IN CONNECTION WITH AIR POLLUTION. *(K metodike izucheniya nespetsificheskoy zabolevayemosti detskogo naseleniya v svyazi s zagryazneniyem atmosfernogo vozdukha). Text in Russian. Gigiena i Sanit., no. 4:65-68, 1974. 6 refs.*

Methodical aspects of the study of the possible relationship between the occurrence of non-specific morbidity and air pollution in children living in specific areas are described on the basis of an example. Children not older than 12 yr were considered for the epidemiological study for which 10% of the children living in the specific city was representative. Children older than 12 yr were excluded due to the possible interference by other factors, such as smoking. Acute respiratory diseases, such as catarrh of the upper respiratory tract, laryngitis, pharyngitis, laryngotracheitis, pneumonia, and bronchitis were considered for the epidemiological survey. Parallel with the epidemiological survey, measurements of the most relevant air pollutants, such as sulfur dioxide, carbon monoxide, nitrogen oxides, dust, and possibly other characteristic pollutants, as well as recording of meteorological data are necessary.

42094 **APTIC NO. 65845**

Cross, Carroll E.

THE GRANULAR TYPE II PNEUMONOCYTE AND LUNG ANTIOXIDANT DEFENSE. *Ann. Internal Med., 80(3):409-411, 1974. 20 refs.*

Type II cells (granular pneumonocytes) in mammalian alveolar epithelium are nearly cuboidal, with abundant cytoplasmic organelles; they participate in the injury and repair processes of pulmonary parenchymal tissue, may be the progenitor of the more numerous type I alveolar epithelial cells, and have a reparative-adaptive response which determines, to some extent, the susceptibility of lung parenchyma to oxidant stress. The type II cells are described and discussed as a defense mechanism against oxidants such as the pollutants nitrogen dioxide and ozone and as progenitors for type I cells. Reparative type II cell proliferation occurs within 24 to 48 hr after oxidant lung damage, and proliferative processes produce tolerance to oxidant- induced pulmonary toxicity. Replacement of attenuated type I cells by type II cells which occurs during the reparative phases of lung injury, may cause a lessened susceptibility to lung damage brought about by many potential forms of lung injury such as oxidant-induced injury.

42095 **APTIC NO. 64088**

French, Jean G.

EFFECTS OF SUSPENDED SULFATES ON HUMAN HEALTH. *Preprint, 7p., 1974. 7 refs. (Presented at the Health Consequences of Environmental Controls: Impact of Mobile Emissions Controls, Durham, N. C., April 17-19, 1974.)*

Recent epidemiological studies indicated that levels of suspended sulfates associated with certain adverse health effects were lower than the levels of sulfur dioxide and total suspended particulates associated with the same health effect. Studies of asthmatics in New York City and Salt Lake Basin showed that increased asthma attacks at 30-50 F were related to suspended particulates and suspended sulfates. Suspended sulfate concentrations in New York City were also related to aggravation of symptoms in cardiopulmonary patients. Other studies revealed that suspended sulfates and nitrates may cause increased asthma attacks at elevated temperatures. The associations in these epidemiological studies by themselves are insufficient to incriminate suspended sulfates as a causative agent, but coupled with animal studies, the observations appear more than spurious. Studies on guinea pigs indicated that some metallic sulfates are more potent irritants than SO2 and that relative humidity is important to effects of SO2/sodium chloride aerosol toxicity. Sulfuric acid mist caused pulmonary deterioration in monkeys. Although many of these studies have limitations, there is sufficient evidence to consider suspended sulfates as potentially injurious to human health.

42096 **APTIC NO. 64326**

Glodan, Lia and Andrei Antal

VARIATION OF THE PSYCHOADAPTATIVE DISORDERS IN SCHOOLCHILDREN IN A TOWN WITH POLLUTED AIR. *(Variations des dereglements psychoadaptatifs chez les ecoliers d une ville a l air pollue). Text in French. Atmos. Environ., 8(5):487-492, May 1974. 14 refs.*

The effects of a high air pollution level in a town on psychoadaptative, cognitive, and behavioral disorders were studied in 1973 schoolchildren in the age group of 7-15 years in a town polluted by atmospheric lead, sulfur dioxide, and zinc. One group comprised children living nearby the emission sources where the average lead concentration was 17.5 micrograms/cu m, and those living at distances of 2500-3000 m where the lead concentration averaged 9.9 micrograms/cu m. The frequency of the psychoadaptative, cognitive, and behavioral disorders was higher in the group living around the emission sources than in the other group living at greater distances from the emission source, even when the sociofamilial conditions were comparable. The frequency of the disorders was highest in the prepuberty stage due to the association of the environmental stress with developmental stresses.

42097 **APTIC NO. 66065**

Goldstein, B., I. Webster, and A. Van As

THE USE OF NONHUMAN PRIMATES IN PNEUMOCONIOSIS AND OTHER INDUSTRIAL DISEASE RESEARCH. *Environ. Res., 7(3):320-329, June 1974. 7 refs.*

In South Africa, monkeys and baboons have been freely available for research into industrial diseases such as pneumoconiosis. The health of new animals must be investigated prior to use. Mean values for right atrial, systemic arterial, and pulmonary artery pressures have 2, 43, 132, and 19.3 mg mercury, respectively Many of the experiments such as the assessment of the dose response to asbestos, the effects of asbestos country rock, the effects of asbestos cement, and the evaluation of prophylactic and therapeutic drugs for silicosis have been of a long-term nature. The only serious disease encountered so far in these long-term experiments was an outbreak of tuberculosis which was difficult to control. Other experiments on the primates concerned the effect of Transvaal crocidolite and the effect of the size of lead particles on their absorption by the body. (Author abstract modified)

42098 **APTIC NO. 63979**

Guizis, S. H. and J. D. Zambakas

THE ADVERSE EFFECTS OF ATMOSPHERIC SMOKE AND SO2 ON HUMAN HEALTH AT TWO LOCATIONS OVER ATHENS. *(Kindynoi ek the pypaneeoe the aunoephaipae eie dyo topotheeiae ton athhnon). Text in Greek. Chem. Chron., 39(1-2):16-20, 1974. 7 refs.*

Days with adverse effects of atmospheric smoke and sulfur dioxide on human health were examined at two sites in Athens for 1971-1972. The criterion was proposed by a World Health Organization Expert Committee on Air Quality Criteria and Guides for Urban Air Pollutants (1972). The first location was the hill of Nymphs, whic was a site of good air quality in the center of Athens. The second site was the University Student s Club in a commercial district. Some sites between the two locations were classified. Many locations in industrial areas were expected to be worse than the University Club with respect to health hazards caused by air pollution. Some suburbs must have had better air quality than the Nymphs hill. The annual arithmetic and geometric mean values of the smoke and SO2 concentrations showed that the atmospheric pollution level at the University Club district caused respiratory symptoms as well as visibility and/or human annoyance effects. No such symptoms occurred at the Nymphs hill. Only 56 days out of 690 had high enough 24-hour SO2 and smoke levels to cause deterioration of patients with pulmonary disease. Three days of the 56 had high enough concentrations to cause excess mortality and hospital admissions. At the Nymphs hill, only 2 days of 659 had concentrations of the pollutants high enough to cause deterioration of patients with pulmonary disease.

42099 **APTIC NO. 63714**

Hofmann, Frank and Manfred Buechner

LEAD POISONING AND AMINO ACID EXCRETION IN URINE. *(Bleiintoxikation und Aminosaeureausscheidung im Harm). Text in German. Z. Inn. Med., 29(7):300-302, 1974. 12 refs.*

Lead-exposed persons were studied to determine toxic effects on urine composition. Only the increased excretion of delta-aminolevulinic acid was a reliable diagnostic indicator of a risk to health. It was difficult to interpret decreased values for alanine, glutamine, glycine, phenylalanine, threonine, and serine in the urine. Increased free hydroxyproline in the urine was probably an expression for an active osseous process due to incorporation of lead, and it seems diagnostically applicable over other indicators together with the excretion of the delta-aminolevulinic acid.

42100 **APTIC NO. 63962**

Isoard, P., J. Bernheim, S. Fournon-Joly, E. Abrigeon, P. Milhaud, A. Flory, D. Germain, and R. Fontanges

THE LYMPHOCYTE KARYOMETRY: ITS APPLICATION TO THE STUDY OF THE BIOLOGICAL EFFECTS OF AIR POLLUTANTS ON THE LYMPHOCYTES OF BALB/C LINE MICE. *(La caryometrie lymphocytaire: application a l etude des effets biologiques des microconstituants atmospheriques sur les lymphocytes de souris BALB/C). Text in French. Biomedicine, 20(2):138-145, 1974. 16 refs.*

Variations of the surface of the lymphocyte nucleus as a function of different parameters were studied in newborn mice by statistical karyometric method. Particulate air pollutants smaller than 10 micron were applied on the nasal mucosa, or injected in the dorsolumbar region in LD50, while another group was exposed to the pollutants in the air. The karyometric results indicate the absence of stimulation of the lymphocytes, i.e., the absence of giant nuclei. Small lymphocytes of long life observed are indicative of the stimulation of the reticuloendothelial system. The stimulating effect of the air pollutants was more pronounced upon inhalation than it was following subcutaneous injection. The modifications in the lymphocytic population were suitable for the study of the biologica effects of air pollutants.

42101 **APTIC NO. 63942**

Kabayama, H. and Y. Yokota

OCULAR AND GENERAL SYMPTOMS OF VICTIMS CAUSED BY TOKYO PHOTOCHEMICAL SMOG. *(Iwayuru Tokyo kokagaku sumoggu higaisha no gan shojo to zenshin shojo ni tsuite). Text in Japanese. Rinsho Ganka (Japan. J. Clin. Ophthalmol.), 28(5):643-646, May 1974. 5 refs.*

An ophthalmological investigation was carried out on pupils who were repeatedly injured in a middle school located in Setagaya Ward, Tokyo, from June to July 1972, possibly by photochemical smog. Main subjective symptoms are ocular pain, headache, and throat pain. Ocular symptoms were tearing, itching, and photophobia. The number of patients with abnormal ocular findings increased rapidly on the day when the oxidant concentration was high; in 15% of pupils without subjective ocular symptoms, findings such as conjunctival redness were observed. Even on the severely injured pupils, there were some who showed no ocular findings, proving that there is no necessary parallel between ocular and general symptoms. Conjunctival redness with enlargement of the annulus capillary was seen in 27% of the pupils in July when high oxidants occurred, as compared to 7.1% in March when no oxidant existed.

42102 **APTIC NO. 65839**

Kahn, Alfred, Robert B. Rutledge, Gustave L. Davis, Jane A. Altes, George E. Gantner, Charles A. Thornton, and Norval D. Wallace

CARBOXYHEMOGLOBIN SOURCES IN THE METROPOLITAN ST. LOUIS POPULATION. *Arch. Environ. Health, 29(3):127-135, Sept. 1974. 24 refs. (Presented at the International Academy of Pathology, San Francisco, Calif., March 13, 1974.)*

The carbon monoxide sources of carboxyhemogloin (COHb) in the St. Louis metropolitan population were investigated. There are few data on the CO burden of an urban population exposed to urban air and to other sources of CO. Data were obtained from the permanent air monitoring stations in the metropolitan area and included ambient CO levels, temperature, wind speed, and wind direction. Hourly averages based on readings every 15 min were used in the calculations. The primary source was smoking, followed by industrial work exposure. It is unlikely that more rigorous CO standards or the related requirements of the Clean Air Act of 1970 on CO emissions by motor vehicles in 1975 will have any effect on body CO burdens. Most persons with 2% COHb level or more were industrial workers or smokers or both. Protection of susceptible individuals from excessive (for them) CO levels may be warranted for an affected group or individual, and can be accomplished at far less cost than ambient air standards for the entire, largely healthy population.

42103 **APTIC NO. 65801**

Kilburn, Kaye H.

CLEARANCE ZONES IN THE DISTAL LUNG. *Ann. N. Y. Acad. Sci., vol. 221:276-281, 1974. 12 refs.*

The evidence which has led to the hypothesis of a two-zone distal lung regarding the clearance of particles of limited solubility or digestibility is discussed. The first zone consists of cul-de-sac alveolar ducts containing resident macrophages and clearing only to lymphatics or blood vessels. The second encompasses distal terminal bronchioles permeable to cilia. The corollaries of this concept are that respiratory bronchioles and proximal alveolar ducts represent a region cleared either way and that the most distal region clears by lymphatics and the more proximal one via the distal extremities of the mucociliary escalator. Various studies on deposition, lung clearance, phagocytosis by alveolar macrophages, and removal by the mucociliary escalator are reviewed. These studies show that alveoli do not clear particles and cells to ciliated airways. Reactions to these retained particles damage alveoli. Distal airways are cleared by ciliary movement and by pulmonary lavage and are the site of sieving of many leukocytes and macrophages recovered from airways. (Author summary modified)

42104 **APTIC NO. 65850**

Klein, Michael C., James W. Sayre, and David Kotok

LEAD POISONING CURRENT STATUS OF THE PROBLEM FACING PEDIATRICIANS. *Am. J. Dis. Child., 127(6):805-807, June 1974. 24 refs.*

The sources of lead poisoning among chidlren is discussed. The paint chip ingestion common among children suffering from Pb encephalopathy, though still the major source, in only one of a number of environmental risks. Milk, polluted air, the use of ceramic drinking vessels, and dust are under careful study. Dust present on household surfaces contains substantially higher amounts on Pb in old inner city homes than in suburban homes. Lead can be found on the hands of children living in inner city homes in higher amounts than on the hands of their counterparts living in suburban homes. Of 344,657 children in 21 cities tested between 1969 and 1971, an overall average of 26.1% had blood levels of 40 micrograms/100 ml or more. A large number of these children are at risk for central nervous system damage.

42105 **APTIC NO. 63603**

Knelson, John H.

MAXIMUM PERMISSIBLE HUMAN STRESS. POLLUTANTS WITH MULTIPLE PATHWAYS: IONIZING RADIATION, ASBESTOS, AND LEAD. *Preprint, 24p., 1974. (Presented at the U. S. - USSR Symposium on Comprehensive Envionmental Analysis, Tibilisi, USSR, March 26- April 1, 1974.)*

The biological effects of ionizing radiation, asbestos, and lead are reviewed in terms of maximum permissible human stress resulting from pollutants with multiple pathways. Topics covered include: dose-response relationships, environmental co-stressors, range of susceptibility, spectrum of response, and the exposure-response matrix. The standard for the multiple pathwya environmental stressor ionizing radiation is set at 170 mrem/yr. From estimates of population risk, the probability of early signs of lung disease from asbestos are less than 1% for 100 fiber years per cubic centimeter. An upper limit for blood lead concentration that can be used as a criterion for setting an air quality standard is concluded to be 30 micrograms/100 ml.

42106 **APTIC NO. 63710**

Koivikko, Antti

CHILDHOOD ASTHMA IN FINLAND. *Acta Allergol., 29(1):30-72, 1974. 53 refs.*

A survey was made of 559 children in Finland suffering from asthma to investigate the general evolution of asthma in childhood, to study factors related to the disease (mainly allergological, social, and regional factors), and to determine the availability of clinical, ivnestigational, and therapeutical facilities. In 85% of the cases, asthma began before 6 years of age. The age of onset was postponed with late breast-feeding and with the late onset of other protein foods. Early onset of asthma did not make asthma severe. The ratio of boys to girls was 1.8:1. Asthma occurring weekly and monthly was observed in 9.1 and 27.5% of the patients, respectively. Asthma occurring five to 10 times/yr was observed in 30.6 and 32.8%, respectively, of the patients who had no asthma or only occasional wheezing episodes. Severity of asthma was not significantly age dependent. Atopic eczema and allergic rhinitis occurred in 52.3 and 41.8% of the patients, respectively. Both were associated with more severe asthma. The frequency and quality of medical contacts increased as the severity of asthma increased, but many severe asthmatics did not have satisfactory medical care. Allergological and symptomatic therapies were applied more frequently in severe than in mild cases. Symtomatic therapies with corticosteroids and ACTH were frequent. Specific hyposensitization therapy was infrequent compared to unspecific therapy. Surprisingly few allergenic or irritant factors in the environment had a worsening effect on asthma. Allergenic factors associated with severe asthma were unavoidable in character. Fungal and house dust allergies were the most probable causes of severe asthma. Social and living conditions had no marked effect on the severity and therapeutic aspects of asthma. Low social status caused a slight excess of severe asthmatics. The mother's working ability lowered by severe grades of asthma. Regional factors did not influence severity of asthma. (Author conclusions modified)

42107 **APTIC NO. 65799**

Lee, Douglas H. K.

PULMONARY REACTIONS TO ORGANIC MATERIALS: DIMENSIONS OF THE PROBLEM. PART I. ASSESSING SPORADIC CASES AND OCCUPATIONAL GROUPS. *Ann. N. Y. Acad. Sci., vol. 221:5-9, 1974. 6 refs.*

There has been an increase in use of plastics, fibers, methanol, and other organic materials and synthetic fibers in the U. S. The production of man-made fibers in the U. S. from 1961 to 1971 increased from 1995 to 6152 million lbs. The production of organic chemicals totaled 243,460 times 10 to the 6th lbs in 1970. As the use of these organic materials has increased, the environmental burden of organic substances has increased, making it more likely that higher concentrations will be encountered in the air, water, and industrial plants. There are significant adverse pulmonary effects caused by enzymes, cotton dust, mold spores, hydrocarbon effluents, and other organic agents.

42108 **APTIC NO. 63465**

Love, G. J.

EPIDEMIOLOGIC STUDIES OF ADVERSE HEALTH EFFECTS ASSOCIATED WITH EXPOSURE TO AIR POLLUTION. *Preprint, Environmental Protection Agency, Research Triangle Park, N. C., Human Studies Lab., 14p., April 29, 1974. 12 refs.*

Epidemiologic studies of the health effects of air pollution in the U. S. are reviewed. They indicate that both acute and chronic health effects are associated with exposure to ambient air containing approximately 100 micrograms/cu m sulfur dioxide, 100 micrograms total suspended particulates, and 15 micrograms/cu m suspended sulfates. The levels of suspended sulfates were associated more closely and more consistently than were the levels of either suspended particulates or SO2. Ranges of current or prior exposure values were developed to represent the worst case and the least case air pollution level which might have been incriminated in a casual manner with adverse health effects measured. Then within these ranges, best judgment estimates were made concerning the levels that most probably were related to the inverse effects. Short-term (24-hour) exposure pollutant thresholds for adverse effects (best judgment) were greater than 365 in micrograms/cu m for SO2, 80-100 micrograms/cu m for total suspended particulates, and 8-10 micrograms/cu m for sulfates for aggravation of symptoms in the elderly, and 180-250, 70, and 8-10 micrograms/cu m, respectively, for aggravation of asthma. Various studies of chronic respiratory disease are reviewed. (Author summary modified)

42109 **APTIC NO. 66077**

Maltoni, Cesare and Giuseppe Lefemine

CARCINOGENICITY BIOASSAYS OF VINYL CHLORIDE. I. RESEARCH PLAN AND EARLY RESULTS. *Environ. Res., 7(3):387-405, June 1974. 25 refs.*

Histological findings are presented from preliminary experiments investigating the carcinogenic potential of vinyl chloride in animals in relation to route of administration, dose level, treatment length, species, strain, and animal age. Administration by inhalation produces Zymbal gland carcinomas, nephroblastomas, and angiosarcomas of the liver and other anatomical sites in rats and pulmonary adenomas, mammary carcinomas, and liver angiosarcomas in mice. A direct relationship appears between dose and length of treatment and neoplastic response. (Author abstract modified)

42110 **APTIC NO. 65838**

Master, Kenneth M.

AIR POLLUTION IN NEW GUINEA CAUSE OF CHRONIC PULMONARY DISEASE AMONG STONE-AGE NATIVES IN THE HIGHLANDS. *J. Am. Med. Assoc., 228(13):1653-1655, June 24, 1974. 15 refs. (Presented at the American College of Chest Physicans Meeting, Toronto, Canada, Oct. 24, 1973.)*

The cause of chronic pulmonary disease among the stone-age natives in the Highlands of New Guinea was investigated. Inhabitants of the villages keep warm during cold nights by burning smoky fires in small closed huts, where they inhale extremely high levels of particulate matter and aldehydes. Pulmonary disease, mainly obstructive but also restrictive, appears at an early age and was present in 78% of subjects over age 40 yr. Severely affected subjects have diminished breath sounds, coarse rales, and decreased chest cage movement. Pathologic specimens from affected subjects demonstrated centrilobular emphysema, thickened pleura, pulmonary fibrosis, mucous gland hypertrophy, and deposition of anthracotic pigment. Smoking is also responsible for the high prevalence of pulmonary disease. (Author abstract modified)

42111 **APTIC NO. 63739**

Mitsui, K. and M. Yanagisawa

CLINICAL STUDIES OF BRONCHIAL ASTHMA IN THE SEASIDE INDUSTRIAL ZONE OF KAWASAKI CITY. *(Kawasaki-shi rinkai kogyo chiku ni okeru kikanshi zensoku no rinshoteki kenkyu). Text in Japanese. Nippon Kyobu Shikkan Gakkai Zasshi (Japan. J. Thoracic Dis.), vol. 12(Suppl.): 30, March 1974. (Presented at Japan Society for Chest Diseases, Annual Meeting, 14th, Tokyo, Japan, April 2-3, 1974.)*

The etiology of bronchial asthma in hospitalized patients in Kawasaki City was studied on 61 males and 29 females older than 30 for 17 months. A tendency towards asthmatic fits in autumn was recognized. There were many cases in which the meteorlogical factors, such as relative humidity and temperature induced the fit; however, there were many exceptions. There were many cases in which the disease began in middle and old age and the influences of air pollution and smoking were noted. Pulmonary emphysema, pulmonary fibrosis, and bronchiolitis were also often present. The % positivity of intracutaneous allergy test was less than 30. The IgG and IgM at the time of fit were generally normal; however, IgA was accentuated in more than half of the patients, suggesting stimulation of air pollutants on immune cells in airway. The therapeutic effectiveness of a clean air ward for asthma was definitive.

42112 **APTIC NO. 63938**

Nagahama, F.

ON THE RELATIONSHIP BETWEEN AIR POLLUTION AND RESPIRATORY DISEASES. *(Taiki osen to kokyuki shikkan). Text in Japanese. Sangyo Igaku (Jap. J. Ind. Health), 16(1):39, 1974. (Presented at the Hokkaido Branch Meeting of the Japan Society of Industrial Health, Hokkaido, Japan, Nov. 17, 1973.)*

The pulmonary clearance mechanism for airborne minute particles and gases constituting air pollution is described. The importance of the mechanism consisting of filtering particulates through the respiratory system was shown by the fact that only 60-80 g of coal dust was found in the autopsied lung of a coal miner who was estimated to inhale 6 Kg of coal dust. Some gases are absorbed on the particles to reduce the pulmonary clearance mechanism, resulting in reduced resistance to infection, disturbed lung function, and destruction of lung tissues. The risk of lung cancer is considered. The effects of air pollution and smoking on the respiratory system of concern because of the rapid increase of lung cancer, chronic obstructive lung diseases, and local asthma in Yokkaichi, Tokyo, and Yokohama.

42113 **APTIC NO. 63940**

Nakajima, T., M. Watanabe, and O. Fukase

EFFECTS OF PHOTOCHEMICAL SMOG ON ANIMALS. *(Kogagaku sumoggu no dobutsu ni oyobosu eikyo). Text in Japanese. Kankyo Gijutsu (Environ. Conserv. Eng.), 3(7):507-512, July 1974. 32 refs.*

Experiments on laboratory animals which elucidate human injuries due to photochemical smog, especially by ozone and oxidant, are reported. Respiratory disturbances, the disturbance of primary alveolar epithelial cells and the cilial changes; general effects, such as the general distribution of a product formed on the surface of airway by the stimulation of ozone; increases of white blood cells and serum alkaline phosphatase; possible effects on central nervous system; peroxidation of alveolar surface matter; chronic effects on respiratory systems; and the effects on immunology and respiratory diseases. Effects of ozone and oxidants on blood, brain, heart, liver, and kidney and carcinogenicity and mutation are discussed.

42114 **APTIC NO. 64222**

Nordberg, Gunnar F.

HEALTH HAZARDS OF ENVIRONMENTAL CADMIUM POLLUTION. *Ambio, 3(2): 55-66, 1974. 69 refs.*

The sources, occurrence, and intake of cadmium are reviewed. Cadmium in the air occurs mainly in particulate form. Annual averages for 1969 in the air in larger cities in the U. S. ranged from 0.006 to 0.036 micrograms/cu m; in European countries, urban values of 0.002-0.005 micrograms/cu m; have been reported; in Tokyo values of 0.01-0.53 micrograms/cu m have been found; in non-urban areas, lower values of 0.001-0.003 micrograms/cu m were found. Although air concentrations of 0.001-0.01 or 0.2 micrograms/cu m will contribute 0.02-0.2 or 4 micrograms/day, respectively, to human intake, cadmium in tobacco, food, and water can add to Cd intake to yield high amounts. Present standards for daily intake do not allow sufficient safety margins. Absorption of inhaled and ingested Cd, transport and distribution in the body, retention and biological half-time, and a mathematical model for cadmium accumulation in the renal cortex are reviewed. Acute and chronic effects are summarized including kidney damage, anemia, hypertension, and liver damage. Using the amount of Cd in the renal cortex which affects the kidney (200 micrograms/g), the necessary daily cadmium intakes from air and food to reach this level are derived. Cadmium pollution is believed to have caused the Itai-Itai disease (renal osteomalacia) in Japan. Epidemiological studies in Fuchu and other areas of Japan, the effect of vitamin D, and the amount of cadmium are related to the Itai-Itai disease. Methods for determining Cd are mentioned. Daily intake of Cd should be limited to 70 micrograms

42115 **APTIC NO. 63939**

Oodaira, T. and Y. Kanae

THE STATE OF PHOTOCHEMICAL SMOG OCCURRENCE IN TOKYO METROPOLIS. *(Tokyo-to ni okeru kokagaku sumoggu hassei no jokyo). Text in Japanese. Kankyo Gijutsu (Environ. Conserv. Eng.), 3(7):463-473, July 1974. 6 refs.*

The number of cases of injuries possibly due to photochemical smog reported to the Tokyo Metropolitan Office is as follows: 10,064 with a peak of 9200 in July 1970; 28,223 with a peak of 19,367 in June 1971; 8437 with a peak of 3814 in June 1972; and 4035 with a peak of 1869 in 1973. The heavily injured (hospitalized) cases totalled 14 in 1970, four in 1971, 43 in 1972, and one in 1973. The oxidant concentration on the day when the reported number was large was generally high. The number of notified injuries in 1973 was the highest from 10 am to noon, consisting of 42.7%.

42116 **APTIC NO. 63731**

Ota, Y.

ON PAO2, AADO2, AADN2, AND RESPIRATORY FUNCTIONAL DISTURBANCE. *(PaO2, AaDO2, aADN2). Text in Japanese. Nihon Kyobu Shikkan Gakkai Zasshi (Japan. J. Thoracic Dis), vol. 12 (Suppl.):4, March 1974. (Presented at Japan Society for Chest Diseases, Annual Meeting, 14th, Tokyo, Japan, April 2-3, 1974.)*

The values of AaDO2, PaO2 and aADO2 of 200 patients complaining of shortness of breath during exercise without abnormal findings from chest-roentgenography or spirography were studied, an abnormal increase of uneven distribution of the ratio of ventilation vs. blood stream was obtained. These methods were applied on the patients of Tokyo photochemical smog and the effectiveness in diagnosis of aADN2 was recognized; however, technical difficulties in determination and problems of collecting arterial blood hindered the interpretation of the values.

42117 **APTIC NO. 63563**

Rodkey, F. Lee, John D. O Neal, Harold A. Collison, and David E. Uddin

RELATIVE AFFINITY OF HEMOGLOBIN S AND HEMOGLOBIN A FOR CARBON MONOXIDE AND OXYGEN. *Clin. Chem., 20(1):83-84, 1974. 16 refs.*

Relative affinity constants of water hemolysates of saline-washed erythrocytes from humans with sickle hemoglobin for carbon monoxide and oxygen were measured to test whether CO in low concentration might be used to increase the oxygen affinity of Hb S while still permitting oxygen transport to a lesser extent. The relative affinity constants measured at 37 C in hemolysates of sickle-positive and non-sickel hemolysates were essentially the same. All samples, regardless of hemoglobin type, showed the same quantitative change of affinity constant with temperature. Conversion of a fraction of Hb S to the carboxy derivative would insufficiently shift the oxygen dissociation curve to be of therapeutic value in therapy of sickle cell disease.

42118 **APTIC NO. 64396**

Rosmanith, Jindrich and Helmut Breining

THE RETENTION AND ELIMINATION OF ZINC AFTER REPEATED INTRATRACHEAL APPLICATION OF ZINC OXIDE TO RATS. *(Die Retention und Elimination von Zink nach wiederholter intratrachealer Applikation von Zinkoxid bei Ratten). Text in German. Staub, Reinhaltung Luft, 34(7): 266-270, July 1974. 42 refs.*

The elimination kinetics of zinc from the lung, liver, kidney, and bones (femur and tibia) of rats following 5 consecutive intratracheal applications of zinc oxide are reported. In each of the tissues assayed, a differing Zn turnover is observed, indicating a constant exchange of Zn. Histologically, an inflammatory process not typical of Zn was observed, which after 8 wk showed a proliferation of reticulum fibers.

42119 **APTIC NO. 65802**

Rylander, Ragnar

INFLUENCE OF INFECTION ON PULMONARY DEFENSE MECHANISMS. *vol. 221:282-289, 1974. 19 refs.*

Airborne microorganisms generated by man can cause morphological and functional changes which sometimes exceed those caused by combustion products. In spite of this, the role of infection has not been adequately evaluated when air pollution effects are studied. Therefore, the importance of local pulmonary infection for the functioning of certain defense mechanisms of the lung is discussed. Lung reactions found in animals exposed to different environment agents with and without prior exposure to infectious agents are reviewed. Results are also reported from experiments where the free lung cell patterns in conventional and infection-controlled guinea pigs were compared under normal conditions and after exposure to cigarette smoke, particles (manganese dioxide and sulfur dioxide), and water extract from cotton mill floor dust. (Author introduction modified)

42120 **APTIC NO. 65785**

Sakurai, Haruhiko, Minoru Sugita, and Kenzaburo Tsuchiya

BIOLOGICAL RESPONSE AND SUBJECTIVE SYMPTOMS IN LOW LEVEL AND EXPOSURE. *Arch. Environ. Health, 29(3):157-163, Sept. 1974. 68 refs.*

Workers occupationally exposed to lead in the air of up to 60 micrograms/cu m were examined for blood Pb(Pb-B), urinary delta-aminolevulinic acid (ALA), erythrocyte ALA dehydrase (ALAD), hemoglobin, hematocrit, red blood cell count, and subjective symptoms. The Pb-B and ALAD showed consistent increases and decreases, respectively, corresponding with the levels of Pb exposure, while other tests revealed no association with Pb. The range of Pb exposure as expressed by Pb-B was up to 50 micrograms/100 gm. Subjective symptoms and urinary ALA are not likely to be increased at the Pb-B level of about 50 micrograms/100 gm and less. (Author abstract)

42121 **APTIC NO. 63949**

Shimizu, Tadahikeo

A STATISTICAL STUDY ON RELATIONS BETWEEN THE SYMPTOM PREVALENCE OF CHRONIC BRONCHITIS AND AIR POLLUTION. *(Mansei kikanshien yushosharitsu to taiki osendo no shihyo). Text in Japanese. Nippon Kyobu Shikkan Gakkai Zasshi (Japan. J. Thoracic Dis.), 12(4):199-206, April 1974. 5 refs.*

From 1970 to 1972, the symptom prevalence of chronic bronchitis was studied in people over 40 years old living in seven districts in Osaka. A statistical analysis was made of the symptom prevalence of chronic bronchitis in reference to air pollution. The relationship between the symptom prevalence of chronic bronchitits and the sulfur dioxide level used as the air pollution index led to the equation y equals 1.96 (alpha) + 2.87, where y was the symptom prevalence of chronic bronchitis in people over 40 years old in %, and alpha was the SO2 value measured by the lead dioxide method in mg sulfur trioxide/day/100 sq cm. The value from this formula was 2.2% higher than obtained for 1962-1966 in Osaka. The relation between the symptom prevalence of chronic bronchitis and nitrogen oxides, instead of SO2, was the equation y equals 0.88 (beta) + 2.81, where beta was the nitrogen oxide value estimated on conjecture by the smoke diffusion equation in pphm. The combined effect of NOx and SO2 was y equals 1.0(alpha-1.0) + 0.6(beta) + 2.7.

42122 **APTIC NO. 65848**

Simons, Jeffrey R., James Theodore, and Eugene D. Robin

COMMON OXIDANT LESION OF MITOCHONDRIAL REDOX STATE PRODUCED BY NITROGEN DIOXIDE, OZONE, AND HIGH OXYGEN IN ALVEOLAR MACROPHAGES. *Chest, 66(1):9S-12S, July 1974 Supplement. 9 refs. (Presented at the Aspen Lung Conference, 16th, Colo.)*

The effects of 80% oxygen and low concentrations of nitrogen dioxide and ozone on alveolar macrophages were investigated. Relatively low levels produce changes in redox states within the alveolar macrophage. With NO2 there were alterations of both cytoplasmic and mitochondrial nicotinamide adenine dinucleotide (NAD plus/NADH) ratios without gross histologic changes. Ozone and O3 produced ratios. A water soluble derivative of alpha-tocopherol protected the mitochondrial compartment of the cells from the effects of NO2 and O2. A common oxidant lesion involving the mitochondrial redox state is suggested. (Author summary modified)

42123 **APTIC NO. 63761**

Speranskiy, S. V.

DETERMINATION OF THE SUMMATION THRESHOLD PARAMETER IN SINGLE INHALATIONAL POISONING OF ALBINO MICE. *(Uchet summatsionno-porogovogo pokazatelya odnokratnykh ingalyatsionnykh zatravkakh belykh myshey). Text in Russian. Gigiena i Sanit., no. 4:72-75, 1974. 8 refs.*

The limits of the toxic effects of acetone, ethylene chlorohydrin, and dichlorodimethyl ether in single inhalations were determined from changes in the summation threshold parameters in albino mice by the measurement if biocurrents. The threshold concentration of dichlorodimethyl ether was 0.6 mg/cu m. While concentrations of 3.1 and 14 mg/cu m had a stimulating effect, the 70 mg/cu m concentration had depressive effect on the nervous system. The threshold concentration of ethylene chlorohydrin (2.9 mg/cu m) caused a significant increase in the summation threshold concentration, and higher concentrations caused even higher increases. Acetone concentrations of 0.25, 0.5 and 1 mg/cu m caused statistically significant increases in the summation threshold concentration, while 2 and 3 mg/cu m concentrations caused increased spread in the summation threshold values. Concentrations of 5 and 10 mg/cu m had a depressive effect on the central nervous system. Triphasal action of these substances on the irritated tissues is indicated. The ratios of LC50 to threshold concentration were 700 for acetone, 98 for ethylene chlorohydrin, and 58 for dichlorodimethyl ether.

42124 **APTIC NO. 64313**

Spicer, Samuel S., Lawrence W. Chakrin, and Joe R. Wardell, Jr.

EFFECT OF CHRONIC SULFUR DIOXIDE INHALATION ON THE CARBOHYDRATE HISTOCHEMISTRY AND HISTOLOGY OF THE CANINE RESPIRATORY TRACT. *Am. Rev. Respirat. Disease, 110(1):13-24, July 1974. 16 refs.*

Lungs of beagle dogs were examined morphologically and histochemically after chronic inhalation of sulfur dioxide. The epithelial changes included squamous metaplasia, which was most prominent and diffuse in the proximal trachea and focal in the more distal respiratory tract. The metaplastic epithelium differed from normal in its formation of sulfated mucosubstance. Mucous goblet cells were sparse and involuted in the surface epithelial of the distal trachea but showed marked hypertrophy and hyperplasia in a large portion of the epithelium of bronchi and bronchioles. The mucous goblet cell secretion, although increased in amount, disclosed moderately to markedly decreased periodic acid Schiff (PAS) reactivity and affinity for basic dyes. Ciliated cells and the surface layer of sulfated mucosubstance presumably derived from these cells were either diminished or absent in bronchi with goblet cell hyperplasia. This depletion correlated with the accumulation of secretion presumably accentuated by impaired mucociliary flow. Accumulations of mucous secretion frequently occupied bronchial and bronchiolar lumens and occasionally extended distally into alveoli. Sessile or pedunculated polypoid protrusions with a partial to complete epithelial covering and fibrous core often projected into the bronchi. Areas of alveolar dilation were observed in SO2-treated dogs but not in control dogs, and possibly resulted from obstruction by the bronchial secretory masses or polyps. Glands of the proximal trachea showed little change, but those more distal in the respiratory tree were greatly increased in number and size and exhibited dilated lumens with little retained intracellular or luminal secretion. Mucous goblet cells in ducts of tracheal and bronchial glands were the only mucigenic structures with normal histochemical properties and morphologic structure other than tracheal glands. Surface epithelium and submucosal mucous glands in the tracheal pouch of SO2-exposed dogs resembled those of untreated animals. (Author summary)

42125 **APTIC NO. 63567**

Stephens, R. J., M. F. Sloan, M. J. Evans, and G. Freeman

ALVEOLAR TYPE 1 CELL RESPONSE TO EXPOSURE OF 0.5 PPM O3 FOR SHORT PERIODS. *Exp. Mol. Pathol., 20(1):11-23, Feb. 1974. 22 refs.*

Young male rats were exposed for 2-6 hr to 0.5 ppm ozone, sacrificed, and examined histologically for damage to the alveolar lining epithelium immediately beyond the cuboidal epithelium of the terminal bronchiole. Type 2 cells and endothelium in this region were very resistant to damage by O3, whereas Type 1 cells were severely injured. The first recognizable change was a mild swelling in the attenuated peripheral cytoplasm of the Type 1 cells, with the process continuing to increase in severity until quite pronounced. Mitochondria, both in the attenuated portions of the cell as well as those around the nucleus, became progressively swollen until they were scarcely recognizable. This was followed either by a sloughing away of the entire cell from the basement lamina or by rupture of the plasma membrane and disintegration of the cell, leaving the basement lamina devoid of an epithelial covering. The endothelium on the opposite side of the basement membrane usually remained normal in appearance. (Author abstract modified)

42126 **APTIC NO. 63876**

Stuik, E. J.

BIOLOGICAL RESPONSE OF MALE AND FEMALE VOLUNTEERS TO INORGANIC LEAD. *Int. Arch. Arbeitsmed., 33(2):83-97, 1974. 24 refs.*

Lead (20 and 30 micrograms/kg body weight/day) was administered as lead acetate during 3 wk to human volunteers of both sexes. The parameters measured were: lead in blood (PbB), erythrocyte dleta-aminolevulinic acid dehydratase activity (ALAD), protoporphyrin IX in erythrocytes (PPE), delta-aminolevulinic acid excretion in urine (ALAU), and hemoglobin (Hb). At first PbB increased and ALAD decreased at the same time (within 3 days). In females PPE started to increase after about 2 wk up to 2 times preexposure values; in males ingesting 20 micrograms/kg/day there was no change. Males ingesting 30 micrograms/kg/day showed a smaller increase of PPE which appeared after 3 wk. The ALAU only increased temporarily in the first wk ingesting 30 micrograms/kg/day. (Author abstract)

42127 **APTIC NO. 63700**

Takhirov, M. T.

EXPERIMENTAL STUDY OF THE COMBINED EFFECTS OF SIX AIR POLLUTANTS ON THE HUMAN ORGANISM. *(Eksperimental noye izucheniye kombinirovannogo deystviya shesti atmosfernykh zagryazneniy na organizm cheloveka). Text in Russian. Gigiena i Sanit., no. 5:100-102, 1974. 8 refs.*

The odor thresholds and reflector effects of acetone, acetic acid, acetic anhydride, formaldehyde, phenol, and hydrochloric acid were studied in 18 subjects. The individual odor thresholds were 0.60 mg/cu m for acetic acid, 0.49 mg/cu m for acetic anhydride, 1.15 mg/cu m for acetone, 0.065 mg/cu m for formaldehyde, 0.022 mg/cu m for phenol, and 0.38 mg/cu m for hydrochloric acid. In a mixture of these gases, the odor thresholds of acetic acid, acetic anhydride, acetone, formaldehyde, phenol, and hydrochloric acid were 0.10 mg/cu m, 0.08 mg/cu m, 0.25 mg/cu m, 0.01 mg/cu m, 0.005 mg/cu m, and 0.07 mg/cu m, respectively. The index of the summation concentration of an odorless mixture was less than 0.90. A mixture with a summation concentration index of 1.04 caused a statistically significant change in the desynchronization of the alpha-rhythms of the brain cortex. These findings are indicative of the total summation of the effects of these small concentrations, and no difference between the short-term and long-term effects was observed. The summation concentration of these substances, expressed as fractions of the respective maximum allowable concentration, should not exceed 1.

42128 **APTIC NO. 63975**

Tanasescu, Gheorghe

THE FACTORS THAT INFLUENCE THE NEUROPSYCHOLOGICAL DEVELOPMENT OF CHILDREN. *(Factorii care influenteaza dezvoltarea neuropsihica a copiilor). Text in Rumanian. Igiena (Bucharest), 23(2):73-86, Feb. 1974.*

A review of the specialized literature concerning the neuropsychological development of children is made. The influence of pathogenic factors, children s activities, human relationships, and economic and social conditions in the family are discussed. Genetic, infectious, endocrinometabolical, nutritional, and traumatic factors greatly affect the brain functions in the fetus and the infant. The influence of environmental pollution on the children s neuropsychological development has been studied in areas polluted with lead as compared to areas with clean air.

42129 **APTIC NO. 63947**

Wada, O.

LEAD, ITS ABSORPTION, EXCRETION AND DISTRIBUTION IN LIVING BODY. *(Kyushu, haisetsu, tainai bunpu Pb). Text in Japanese. Sogo Rinsho (Clinic All-Round), 23(1):46-51, Jan. 1974. 33 refs.*

The routes of environmental lead to mankind; the environmental distribution of lead, especially in air, foods and tobacco; the intake and absorption of environmental lead by a normal person; excretion of lead from the kidney; the distribution of lead in the human body, and the indicators of lead in environment and in humans are reviewed. Auto exhaust from leaded gasolines have increased atmospheric concentrations of Pb 5%/yr. The human intake of lead directly from air averages 30 micrograms/day, about 1/10 of total intake. The absorption of lead inhaled is 29%. There is a logarithmic correlation between concentrations of lead in human blood and in the air, and the accumulation of lead in human body depends upon the aerial concentration of lead. Concentrations of lead are tabulated occupationally and geographically.

42130 **APTIC NO. 65779**

Wallace, Norval D., Gustave L. Davis, Robert B. Rutledge, and Alfred Kahn

SMOKING AND CARBOXYHEMOGLOBIN IN THE ST. LOUIS METROPOLITAN POPULATION. *Arch. Environ. Health, 29(3):136-142, Sept. 1974. 19 refs.*

The uptake of carbon monoxide by humans exposed to multiple sources is discussed. The carboxyhemoglobin (COHb) buildup is shown for constant exposures that would cause the same equilibrium level as smoking. If random samples were made of the COHb of subjects who smoke at an average rate of 1/hr or 2/hr and at various times after the beginning of smoking, an average curve would be generated that looks like the buildup curve for a constant exposure. Ambient CO is dangerous because of the manner in which varying levels of CO exposure are converted to COHb by the human body. Real increments in nonsmokers COHb occurs in smoke-filled rooms. Increases of 1.6% to 2.6% saturation COHb were measured in the blood of nonsmokers exposed in smoke-filled rooms to 38 ppm CO for 78 min.

42131 **APTIC NO. 65786**

Werthamer, Seymour, Pedro Daniel Penha, and Leonard Amaral

PULMONARY LESIONS INDUCED BY CHRONIC EXPOSURE TO OZONE. I. BIOCHEMICAL ALTERATIONS. *Arch. Environ. Health, 29(3):164-166, Sept. 1974. 15 refs.*

The effect of prolonged and repeated exposure of mice to low levels of ozone was investigated. Ten-week old Swiss-Webster male mice Of a tumor resistant strain were exposed daily for 2 hr to 2.5 ppm 03 for 120 consective days. Severe alterations were observed in the synthesis of lung DNA (decreased), RNA (decreased), and protein (increased.) Parallel studies involving key enzymes (glutamic oxaloacetic transaminase, lactic dehydrogenase, and alkaline phosphatase) correlated with the aforementioned synthesis suggested that the effects of O3, later demonstrable in the appearance of lung abnormalities, are first preceded by biochemical changes, all of which are related to cell injury. (Author abstract modified)

42132 **APTIC NO. 63734**

Yokoyama, T.

AIR POLLUTION AND PULMONARY FUNCTION. *(Taiki osen to hai kino) Text in Japanese. Nihon Ishikai Zasshi (J. Japan. Med. Assoc.), 71(6):881-884, March 1974. 18 refs.*

The clinical status of respiratory disturbances due to synergistic actions of air pollutants is discussed. The methods and items of examining such disturbance are: spirometry, oscillation, closing volume, degree of dependence of dynamic lung compliance on frequency, flow-volume curve, gas-distribution in the lung, gases in arterial blood, and the differential of alveolar-gas and arterial-gas. The cases of abnormal gas in arterial blood with normal ventilatory function by spirometry have been increasing. The respiratory disturbance caused by oxidants belongs in this category. The diversity of patterns of respiratory disturbance caused by multiplied pollutants can not be generalized simply by the traditional conception of chronic bronchitis, but would cover almost all patterns of modern respiratory diseases.

42133 **APTIC NO. 63716**

Yoshida, R.

CHILDREN S COUGH BY AIR POLLUTION - HOW TO CONSIDER THE INFLUENCE OF AIR POLLUTION. *(Yoji no seki: Taiki osen ni yoru mono- taiki osen no eikyo o do kangaeruka -). Text in Japanese. Shonika (Pediatrics), 15(5):377-380, 1974. 3 refs.*

Additive and multiple actions of pollutants, on childhood cough status is considered as an acute and a chronic symptom. Three famous acute episodes are described, and general symptoms are listed. Epidemiologically recognized chronic influences of air pollution on children are the tendencies toward morbidity of common cold, diseases in lower airway, increase of school absence, reduction of lung function, and increase of morbidity of asthmatic bronchitis, bronchial asthma and chronic bronchitis. A positive correlation between the aerial concentration of SO2 and the morbidity of bronchial asthma around the SO2 monitoring point was found. In reference to the national system of compensating health damages by public nuisance, the impossibility of correlating individual symptoms such as cough to air pollutants in the chronic cases is stated.

42134 **APTIC NO. 63944**

Miyagi Prefectural Office (Japan)

RESULTS OF LUNG FUNCTION EXAMINATION. *(Kokyu kino chosa kekka). Text in Japanese. Miyagi-ken Kogai Shiryo (Data Public Nuisances, Miyagi Prefect.), no. 10:115-129, Jan. 1974.*

The results of lung function examination on inhabitants in general in two areas (A and B) of Ishinomaki City, carried out on March 22-24, 1973 are given. The number of inhabitants examined was 124 in A and 56 in B. There was a large difference in the constitution of the population between A and in B; inhabitants of A were generally younger than in B. According to the answers to questionnaires concerning symptoms of respiratory diseases, there was no difference between A and in B in all items. No difference in airway resistance was found between inhabitants in A and in B, in both sexes. No difference of percentage of vital capacity and one sec rate by spirometer was found between inhabitants in A and B in both sexes. Analysis of flow-volume curves showed no difference between inhabitants in A and in B. Inability to find any difference in lung function was attributed to the difference in age of the population.

1973

42135 **APTIC NO. 64054**

Bavley, Harold and Robert F. Cashins

ENVIRONMENTAL HEALTH ASPECTS OF CONSTRUCTION OF THE NORTHFIELD HYDROELECTRIC PROJECT. *Am. Ind. Hyg. Assoc. J., 34(1):38-47, Jan. 1973. 5 refs.*

Potential health hazards encountered by workers during the construction of a hydroelectric power facility located within a mountain in Massachusetts are discussed. The concentrations of rock dust in the work atmosphere during the wet drilling and mucking operations did not present an overall hazardous exposure to the workers. This was true of the nitrogen dioxide and carbon monoxide concentrations during the operation of diesel-powered equipment and on re-entry into the work areas after blasting when safety requirements were met. A complaint- free atmosphere is maintained if the nitrogen dioxide in the work area is kept low during the operation of diesel-powered equipment. The general ventilation provided through the tunnel roof-hung ventilating system is adequate for operations; occasionally additional portable and locally-installed auxiliary air-moving equipment was necessary. Incidence of dermatitis during the spray-coating of tunnel sections is minimal. Further studies are necessary to evaluate potential hazards presented by the finishing operations and the installation of the power-generating equipment. (Author summary)

42136 **APTIC NO. 63847**

Beck, E. G., M. Manojlovic, and G. Trapp

THE EFFECTS OF PARTICULATE AND GASEOUS AIR POLLUTANTS ON CELLS CULTIVATED IN VITRO. *(Die Wirkung von partikel- und gasfoermigen Luftverunreinigungen auf in vitro gezuechtete Zellen). Text in German. Zentralbl. Bakteriol. Hyg. Infektionskr. Abt. Orig., 158(2):125-142, 1973. 18 refs.*

Experiments were performed on the effects of ambient dusts and carbon monoxide applied alone or in combination to cells cultivated in vitro. Cell permeability was employed as a cytotoxical parameter. Fluorochromasia on the one hand and the release of fluorochromes or intracellular enzymes on the other hand served as criteria of permeability. The methods for the determination of these criteria were impulse cytophotometry, fluorochrome photometry, and the determination of enzyme activity in the supernatant. These three methods are sensitive and can be performed routinely. For impulse cytophotometry cells of suspension cultures are most suitable, whereas monolayer cultures are most preferable for fluorochrome photometry and enzyme determination. Ambient dusts from Bochum and Duesseldorf have cytotoxic properties. Even a short time after incubation (50 to 100 micrograms fine dust/10 to the 6th cells) an impairment of cellular permeability can be demonstrated. Carbon monoxide (1000 and 10,000 ppm) alone also interferes with cell permeability. An action of CO on cell metabolism via the respiratory chain is discussed. Carbon monoxide (1000 ppm) increases the effect of ambient dust from Bochum on cells of the L line (100 micrograms/10 to the 6th cells) and that of dust from Duesseldorf on guinea pig alveolar macrophages (50 micrograms/10 to the 6th cells). Cell cultures are suitable test systems for the investigation of the biological effects of particulate and gaseous air pollutants applied alone or in combination.

42137 **APTIC NO. 61069**

Burkhanov, A. I and R. K. Zhakenova

CHANGES IN THE LUNGS FOLLOWING INTRATRACHEAL ADMINISTRATION OF ELEMENTARY SELENIUM TO WHITE RATS. *(Izmeneniya v legkikh pri intratrakheal nom vvedenii belym krysam elementarnogo selena). Zdravookhr. Kaz, vol. 3:52-53, 1973. Translated from Russian, 3p.*

Rats were given a single intratracheal dose of 50 mg of elementary selenium dust in the form of a suspension of 0.6 ml of physiological solution and sacrificed at various intervals ranging from 1-12 months following initiation of poisoning to study the effect of the dust on the respiratory system. Visual and microscopic inspection revealed development of a diffuse-sclerotic form of slowly progressive pneumoconiosis, accompanied by the development of primarily large-focal emphysema against the background of inflammatory-purulent changes.

42138 **APTIC NO. 64195**

Crocker, T. T.

NITROGEN OXIDES - ANIMAL EFFECTS. *Preprint, National Academy of Sciences, Washington, D. C., 18p., 1973. 28 refs. (Presented at the National Academy of Sciences Conferences on Health Effects of Air Pollutants, Washington, D. C., Oct. 3-5, 1973.)*

The results of animal studies investigating the effects of nitrogen dioxide are reviewed in an attempt to arrive at objective grounds for an NO2 standard. There appears to be no threshold level for NO2 so far as some detectable alteration of lung function or structure in animals is concerned. A threshold may be reached for an effect contributing to clinical infectious disease in animals at about 2 ppm for between 4-17 hrs; at this level detectable changes occur in man. Prolonged exposure at low concentrations produces progressive alterations; hence, ceilings for human health protection need to specify manual averages. Intermittent exposure at concentrations of 0.5 ppm may suppress resistance to infection more effectively than continuous exposure; hence, periodic elevations of NO2 are also a potential hazard to human health. Peak exposure limits should therefore be incorporated in air quality standards to control 1-3 hr elevations of NO2, with a maximum concentration being set at 0.5 ppm in view of animal experiments and the comparability of human and animal responses observed. A value of 0.35 ppm for 1 hr is supported by animal studies, would be consistent with epidemiologic data, and would represent 1/6 the concentration which leads to altered ventilatory function in human subjects in short exposure periods.

42139 **APTIC NO. 63521**

Dorough, H. Wyman

METABOLISM OF CARBAMATE INSECTICIDES (FINAL REPORT). *Kentucky Univ., Lexington, Dept. of Entomology, Environmental Protection Agency Grant R-802005, Program Element IE1078, EPA-650/1-74-002, 255p., Sept. 1973. 75 refs.*

The metabolic fate of aldicarb, carbaryl, and carbofuran was investigated in a variety of biological systems. The effects of other insecticides and certain monoamine oxidase inhibitors on carbaryl metabolism in rats was also studied. The fate of 3-hydroxy carbofuran, its glucoside and glucuronide, and naphthyl glucoside in rats was determined. Using 1-naphthol as a model compound, in vitro methods were developed to study mechanisms of glycosylation ininsects and mammals. The glucosides of 4- and 5-hydroxy carbaryl were prepared chemically and their acute toxicity to mice compared to the aglycones. Carbamate insecticides are metabolized initially by hydrolytic- and oxidative-type reactions and the resulting products are then almost totally conjugated. These conjugated products constitute the majority of the terminal residues of carbmates in both animals and plants. (Author abstract modified)

42140 **APTIC NO. 63968**

Ehato, T.

PATHOLOGY OF RESPIRATORY DISEASES CONCERNING AIR POLLUTION, ESPECIALLY DESCRIBED ON THE PATHOLOGICAL FINDINGS ON THE LUNGS OF INHABITANTS IN CITIES AS A CENTER. *(Byori: Toshi seikatsusha no hai-byori shoken o chushin to shite). Text in Japanese. Nihon Kyobu Shikkan Gakkai Zasshi (Japan. J. Thoracic Dis.), 11(12):713-718, Dec. 1973. (Presented at the Japan Society for Thoracic Diseases, Annual Meeting, 23rd, Symposium on Air Pollution and Respiratory Diseases, 2nd, April 1973.)*

Pathological studies of 321 lung samples revealed morbidity of anthracosis, pneumoconiosic nodes, interstitial pneumonia, and chronic bronchitis, in that order. Lung cancer, squamous epithelial metaplasia of bronchial mucosa, and proliferation of smooth muscles on the alveolar wall were also noted. Pathological changes in the lungs of patients living in urban areas was unexpectedly high, even in younger persons. Anthracosis and pneumocosis were seen most frequently in the southern part of Tokyo where there is a great deal of dust fall; however, more cases were appearing steadily in other parts of the city suggesting the spread of air pollution. No regional differences in the morbidity of chronic bronchitis were seen, suggesting engine exhausts as a primary source. Chronic bronchitis occurs frequently without any noticeable symptoms. There are many cases of interstitial pneumonia accompanying changes of the arterioles, and the effects of air pollution of the intrapulmonal vessels should be studied. There is a relationship between increases in lung squamous epithelioma and dust fall.

42141 **APTIC NO. 64089**

Frankstein, S. I., T. I. Sergeeva, Z. N. Sergeeva, and E. S. Ivanova

DO THE RESPIRATORY MUSCLES AND LUNG RECEPTORS INFLUENCE THE RESPIRATORY SENSITIVITY TO CO2? *Experientia, 29(4):437-439, April 15, 1973. 12 refs.*

An investigation was made to know whether afferent impulses from the respiratory muscles and from the lungs change respiratory sensitivity to carbon dioxide. Ten adult cats were anaesthetized and subjected to passive overventilation lowering the Pa CO2 till the appearance of hypocapnic apnoe. Expired volumes were measured, electromyograms were recorded, and blood samples were taken. Respiration after apnoe in five spinalized cats was at Pa CO2 equal to 44 mm mercury instead of 34 mm mercury as before spinalization. Thus, the respiratory sensitivity to CO2 after spinalization decreased. The decrease did not depend on the ablation of the afferent respiratory muscle impulses, but rather on the increase of Pa CO2 following spinalization. Double vagotomy in the mid-cervical region was performed in five cats. Before vagotomy, the respiration after apnoe began at Pa CO2 equal to 37.1 mm Hg, after vagotomy at 30.4 mm Hg. Thus the respiratory sensitivity to CO2 after vagotomy increased. Again, it did not depend on the ablation of afferent vagal impulses, but rather on the decrease of Pa CO2 following the vagotomy. Thus, neither the impulses from the respiratory muscles nor the impulses from the lungs influenced the respiratory sensitivity to CO2. There must be some other mechanisms to explain the effect of muscle paralysis and vagal blockade in breathlessness.

42142 **APTIC NO. 63850**

Furuuchi, I., Y. Okuzawa, M. Hasegawa, Y. Iwai, M. Asai, S. Shimada, S. Ushijima, Y. Nagano, and H. Michishita

THE RELATIONSHIP BETWEEN AIR POLLUTION AND THE NASAL MUCOSA: ON THE LIMITS OF NASAL ALLERGY. *(Taiki osen to hana nenmaku tono kankeihana arerugi no shuhen ni tsuite). Text in Japanese. Jibi Inkoka (Ontolaryngol.), 45(10):713-728, Oct. 1973. 23 refs.*

The relationship of the hypersensitivity of the nasal mucosa to the behavior of the nose as the primary filter of inahled air was investigated by questionnaires given to schoolchildren in polluted and unpolluted areas and by consideratio of the relationship to the problem of nasal allergies and the lower filter. When the hypersensitivity of the nasal mucosa is reduced a compensatory burden is charged to the lower filter and emergency signals and symptoms are issued from the lower filter. With the nasal mucosa filter functioning normally a single bit of nasal information (nasal discharge in lower school grades, nasal obstruction in middle grades, and sneezing in higher grades) is an emergency signal for the normally functioning mucosa and can be used as a criterion for healing in the treatment of nasal allergy. A disease syndrome consisting of the symptoms nasal discharge, nasal obstruction, sneezing, allergic disposition, ocular symptoms, and hypersensitivity of the nasal mucosa is described. The diseases which come under this syndrome include the hypersensitive filtration reaction, vasomotive rhinitis, and acute rhinitis or asthmatic bronchitis accompanied by ocular symptoms especially under the influence of air pollutants, all of which would necessarily be differentiated from atopic nasal allergy. Thus it is necessary to decide whether nasal information is a signal or a symptom before treatment. When the information continues, of course, it is necessary to give adequate and early treatment.

42143 **APTIC NO. 63584**

Gordon, R. J., R. J. Bryan, J. S. Rhim, C. Demoise, R. G. Wolford, A. E. Freeman, and R. J. Huebner

TRANSFORMATION OF RAT AND MOUSE EMBRYO CELLS BY A NEW CLASS OF CARCINOGENIC COMPOUNDS ISOLATED FROM PARTICLES IN CITY AIR. *Int. J. Cancer (Munksgaard), vol. 12:223-232, 1973. 14 refs.*

The customary benzene extraction of airborne particulate matter collected in Los Angeles yields carcinogenic material. The residue from the benzene extraction contains substances soluble in methanol, some of which are organic. This methanol extract and a number of its component fractions were tested in rodent cell culture systems developed as assay methods for screening carcinogens. In one system, a high-passage Fischer rat embryo cell line was used. In the other, a low-passage cell line derived from NIH Swiss albino mouse embryos and infected with AKR leukemia virus was used. In both systems, the methanol extract showed cell transformation activity approaching that of 3-methylcholanthrene. In the mouse cell system, the activities of several fractions were also examined. The major inorganic component, ammonium nitrate, showed no activity. Neither the neutrals alone nor the recombined nonneutral fractions separately showed any activity, although they were active together. The basic materials separated by ion exchange were also active. The basic materials separated by ion exchange were also active. The methanol extract combined with the conventional benzene extract showed much lower activity than either extract alone. (Author abstract)

42144 **APTIC NO. 64083**

Gordus, A.

FACTORS AFFECTING THE TRACE-METAL CONTENT OF HUMAN HAIR. *J. Radioanal. Chem., vol. 15:229-243, 1973. 16 refs.*

Present-day and historical hair samples up to 300 years old are being analyzed by neutron activation analysis for more than 30 trace elements. The study, designed to determine a historical base-line for the human intake of trace metals and to provide an evaluation of the present-day rate of increase and sources of environmental pollution, has direct forensic applicability. Modern samples analyzed include hair from U. S. Naval Academy midshipmen and U. S. Air Force Academy cadets obtained upon arrival at the Academies in mid-1971 and at later intervals during which trace metal equilibration due to fixed diets and environmental conditions were presumed to occur. A wide variety of factors such as age, sex, hair structure and color, geographic location, general diet, and socioeconomic status are being evaluated. Examples of some of the initial data obtained from the analysis of the first three sets of Naval Academy midshipmen hair are presented. (Author abstract modified)

42145 **APTIC NO. 63735**

Hattori, M.

MORPHOLOGICAL ALTERATION OF RESPIRATORY SYSTEM DUE TO AIR POLLUTION. *(Hatsugen; kokyukikei no keitaigaku-teki henka). Text in Japanese. Nippon Kyobu Shikkan Gakkai Zasshi (Japan. J. Thoracic, Dis.), 11(12):746-747, Dec. 1973. (Presented at the II Symposium Air Pollution and Respiratory Diseases at the 13th Annual Meeting of the Japan Society for Thoracic Diseases, April, 1973.)*

Lung autopsies on inhabitants of air polluted areas show black lesions caused by sedimented coal dust and pulmonary emphysematous lesions; the hypertrophy of the mucousal gland was higher and metaplasia of squamous epithelium was more numerous in the bronchus; the content of nickel was higher in relatively more cases; and chromium was higher in lung tissue than from inhabitants in non-air polluted areas. These alterations accelerated aging and affected the general condition of the whole body. Exposure of mice to the same concentration of NO2 as occurs in ordinary air shows the formation of hyperplastic foci on bronchial epithelium and noticeable pulmonary fibrosis. Chronic inflammation of bronchus and lung were accompanied sometimes with heteromorphic proliferation of bronco-epithelial cells in the mice bred in polluted air for a year. If the effects of carcinogenic substances in the air or in tobacco smoke add to such health problems, the onset of carcinoma must be considered.

42146 **APTIC NO. 61071**

Kirchgessner, M. and J. Pallauf

THE EFFECT OF IRON, COBALT OR NICKEL SUPPLEMENTS IN ZINC DEFICIENCY. *(Zum einfluss von FE-, Co- bzw. Ni-zulagen bei zinkmangel). Z. Zierphysiol. Tierenaehr. Futtermittelkd., vol. 31:268-274, 1973. 14 refs. Translated from German, 11p.*

Iron, nickel, and cobalt were fed to rats on a semisynthetic zinc-deficient ration to study the interactions between zinc and the added elements and to investigate their zinc replacement potential. Growth and zinc deficiency symptoms did not change by the dietary additions of Fe, Co, or Ni as compared to controls on a basal diet. The highest additions of each element (2000 ppm Fe, 50 ppm Co, and 50 ppm Ni) did, however, result in an increase of the hemoglobin values. Zinc content of the liver was increased by the additions of Fe. Additions of Co reduced in part the Zn content of the liver and serum, whereas Ni supplementations at all levels generally reduced the serum Zn and for the most part increased the Zn concentration in the liver. The results indicated interactions between Zn and Fe as well as between Ni and Co in the intermediary metabolism, but no replacement or sparing effects were observed for the added elements. (Author summary modified)

42147 **APTIC NO. 64335**

Kosmider, Stanislaw

THE OCCURRENCE OF RESPIRATORY DISEASES AS AFFECTED BY THE PRESENCE OF SOME GASEOUS POLLUTANTS IN THE ATMOSPHERIC AIR. *(Wplyw niektorych zanieczyszczen gazowych atmosfery na powstawanie chorob narzadu oddechowego). Text in Polish. Pol. Arch. Med. Wewn., 50(5):417-425, May 1973.*

Studies conducted on populations exposed to intensive air pollution and experiments conducted on animals proved that gaseous pollutants in the atmosphere increase the occurrence of respiratory diseases in both humans and animals. Most affected are people who have a previous history of respiratory and heart diseases, children, and old people. Sulfur and nitrogen oxides, appearing also in tobacco smoke, cause most pathological changes in the respiratory system. Coughing and shortness of breath are the typical symptoms of bronchitis and degeneration of bronchial cells. Studies conducted on 20 rats as compared to 25 control rats, and 4 on 70 humans exposed to nitrogen oxides as compared to 80 healthy persons, at 2.0 ppm concentrations for respectively 4 wk and 1 yr, indicated that both humans and animals excreted hydroxypyrolines, a product of colagen decomposition, as well as mucopolysaccharides. Long exposure led to emphysema. Albumin synthesis is affected and weight increase is hindered. In mice exposed to 1.5 ppm sulfur dioxide for 20 days at concentrations varying from 1,600,000 Diplococcus pneumoniae/ml to 100,000 D.p./ml mortality from pneumonia was double in the exposed group. Monkeys affected with various pneumonia types reacted with 0%, 25%, and 28% mortality for groups exposed to fresh air from 1 to 2 mo before infection, 10 ppm nitrogen oxides 1 mo before infection, and 5 ppm for 2 mo before the infection, respectively. Exposure to clean air, 10 ppm NO, and 5 ppm NO 24 hr after infection, the given groups showed 0%, 100%, and 33% mortality, respectively. Infectious respiratory diseases occur twice as frequently in people exposed to noxious gaseous compounds found in the atmosphere.

42148 **APTIC NO. 63587**

Landahl, H. D.

A MATHEMATICAL MODEL FOR PARTICULATE DEPOSITION IN THE RESPIRATORY SYSTEM. *p. 177-191, 1973. 19 refs. (No further citation information available.)*

A model for the assessment of the hazard of an inhaled airborne material requires an estimate of its distribution of deposition and its subsequent redistribution throughout the body. From a model of the human respiratory system based on anatomical measurements and from the physical laws which govern the impaction, diffusion, and settling of particles, one can make reasonable estimates of the concentration of the particulates in various fractions of the exhaled air. Since these values are in general agreement with experimental data, one can expect the estimates of the amounts of the airborne material deposited in various parts of the respiratory system to be reasonably accurate. These values cannot be directly measured for human subjects. Some of the factors involved in the redistribution of deposited materials in the respiratory tract are discussed. A model for these factors is given and illustrated by some examples. Retention of the particles in nasal passages and lungs is also described. (Author summary modified)

42149 **APTIC NO. 63453**

Lave, Lester B. and Eugene P. Seskin

AN ANALYSIS OF THE ASSOCIATION BETWEEN U. S. MORTALITY AND AIR POLLUTION. *J. Amer. Stat. Assoc., 68(342):284-290, June 1973. 23 refs.*

U. S. mortality rates (total, infant, and disease-specific) across 117 standard metropolitan statistical areas in 1960 and 1961 are reviewed in an attempt to estimate their association with measures of air pollution. Multivariate regression analysis is used to control some of the important factors affecting mortality with the underlying hypothesis that air pollution will exhibit a significant association with mortality in the presence of other relevant factors. Important factors include age, sex, genetic factors, nutrition, cigarette smoking, exercise habits, income, race, level and quality of medical care, occupation - including accident rate and pollution exposures, population density, weather, housing - including type of home heating, and all other factors, as well as both current and cumulative air pollution. Air pollution data used are suspended particulate and total sulfate concentrations. Taken as a whole, the analysis demonstrates a close association between air pollution and mortality, and the estimated magnitude of the relationship is substantial. The relationship between air pollution and deaths by specific diseases is mentioned. (Author abstract modified)

42150 **APTIC NO. 65945**

Lawther, P. J.

MEDICAL EFFECTS OF AIR POLUTION. *Inst. of Fuel, London (England), Fuel Environ. Proc. Conf., Eastbourne, England, 1973, p. 123-127. (Nov. 26-29, Paper 9.)*

Experimental and epidemiological studies are cited regarding the toxicological effects of carbon monoxide, sulfur oxides, particulates, and nitrogen oxides resulting from the combustion of fuels. Studies of ambient CO levels and human carboxyhemoglobin levels indicate that 20% COHb levels can cause health and performance impairment, with saturations as low as 5% capable of having measurable effects on cardiac function. There is little convincing evidence that CO concentrations giving less than about 8% saturation have any effect on perception. Experiments involving the administration of 1% sulfur dioxide to sensitive people indicate increases in airway resistance which could be highly undesirable in patients whose ventilation/perfusion ratios are already disturbed. Epidemiological studies indicate positive correlations between smoke and SO2 concentrations and the health of patients with fairly severe chest disease. Laboratory studies also indicate that the growth of hemophilus influenzae, a microorganism normally found in the sputum of patients with chronic bronchitis, is affected by particulate matter in the air. Nitrogen dioxide in high enough concentrations is capable of producing pulmonary edema in humans, and animal experiments involving concentrations not much higher than those occasionally found in the air, i.e., 0.1-0.2 ppm, can produce cellular alterations and structural changes resembling those seen in some human lung disease.

42151 **APTIC NO. 65797**

Sanai, Gholam Hossein, Nooridin Ziai, Akbar Ghiasni, and Ali Ghasemi

INVESTIGATION OF LEAD INTOXICATION IN TEHERAN TILE MANUFACTURING WORKERS. *Ind. Health (Japan), 11(4):197-201, Dec. 1973. 6 refs.*

A survey was made among the workers of 17 workshops and two factories of tile manufacturing plants for any probable lead intoxication due to the use of lead in the glaze. The comparison was made by the determination of lead and coproporphyrin in the urine and hemoglobin and the presence of basophylic stippled cells in the blood of both groups as well as in the control. Due to the use of prefabricated glazing material, automation of the process, and absence of lead fumes and dusts, no cases of intoxication were observed among the workers of the factories. Several cases of higher values of lead in urine, the presence of coproporphyrin and stippled cells, and decrease of hemoglobin were noted in workers at workshops where metallic lead was molten and used in a glaze under unfavorable conditions. (Author abstract)

42152 **APTIC NO. 64412**

Sebastien, P., M. C. Jaurand, G. Bonnaud, J. Goni, and J. Bignon

CURRENT METHODS OF DIAGNOSING PULMONARY ASBESTOSIS BY USING VARIOUS PHYSIOCHEMICAL MICRO METHODS FOR IDENTIFYING FIBROUS PARTICLES. *(Possibilities actuelles du diagnostic de l asbestose pulmonaire en utilisant diverses micro-methods physico-chimiques pour l identification des particules fibreuses). Text in French. Arch. Maladies Profess. Med. Trav. (Paris), Securite Sociale (Paris), 34(6):335-344, June 1973.*

A methodology or recognizing and enumerating the various kinds of asbestos fibers in biological samples of pulmonary origin is described. The methodology proposed allows identification and quantification of fibers. The mineralogic identification is made by an electron scanning microscope. The crystalline structure is obtained by diffraction. A polarizing optical microscope can be successfully used for identification due to the different optical characteristics of these minerals. In order to determine the quantity of the asbestos particles in the lungs, their number is calculated in expectoration, or lung biopsies. The methods presented have been successfully used in rapid clinical diagnosis of pulmonary asbestosis.

42153 **APTIC NO. 64230**

Stewart, Richard D., Edward D. Baretta, Leigh R. Platte, Elizabeth B. Stewart, Hugh C. Dodd, Karen K. Donohoo, Sally A. Graff, John H. Kalbfleisch, Carl L. Hake, Barbara Van Yserloo, Alfred A. Rimm, and Paul E. Newton

NORMAL CARBOXYHEMOGLOBIN LEVELS OF BLOOD DONORS IN THE UNITED STATES. *Medical College of Wisconsin, Milwaukee, Dept. of Environmental Medicine, Environmental Protection Agency Contract 68-02-0080, Proj. CAPM-8-68, Program Element 1AA005, EPA- 650/1-73-004, 248p., May 1973. 15 refs.*

A national survey was conducted in 1969-1972 to determine the range of carboxyhemoglobin (COHb) in various segments of the American population. Venous blood samples were obtained from 29,000 adults at arbitrarily chosen blood bank collection sites. From every 10th participant, an alveolar breath sample was obtained for carbon monoxide analysis and correlation with the COHb. At the time of blood collection, detailed questionnaires were completed so that the influence of demographic variables could be assessed. There was excellent agreement between the two independent analytical methods used to analyze COHb. The mean COHb saturation of 0.45% of the adults breathing CO-free air demonstrated the sensitivity of the analytical methods in detecting low concentrations of COHb. Forty-five percent of all the non-smoking blood donors tested had COHb saturations greater than 1.5% and indicated that exposure to CO in excess of that permitted by the Air Quality Standards is widespread and occurring regularly. Tobacco smoking was the single most important factor responsible for the highest COHb saturations observed. The other chief factors influencing the COHb saturation were the geographical location of the individual, his occupation, and the existing meteorological conditions. None of the large urban communities had CO concentrations low enough to comply with the EPA ambient Air Quality Standards for CO. (Author abstract modified)

42154 **APTIC NO. 63750**

Tokyo Metropolitan Government (Japan), Meguro District Dept. of Construction Pollution

THE 1972 POLLUTION SURVEY REPORT. *(Kogai chosa hokokusho Showa 47-nendo). Text in Japanese. 72p., Nov. 1973.*

Studies of the Meguro district and bronchial asthma, chronic bronchitis, emphysema, and lung cancer patients were made in November of 1972 and February and March of 1973. Two areas with high levels of carbon monoxide pollution (13.93 and 13.08 ppm) and three with less pollution (6.09, 6.60, and 6.03 ppm respectively) were selected and 45 patients were examined for subjective and objective symptoms. Appetite or sleep impairment, breathing difficulty, coughs, sputum, cyanosis, anemia, and swollen fingers were examined. Clinical examinations of blood pressure, urinalysis, hematological symptoms, chest-X-rays, lung functions, and cardiographs, were done. Nineteen people had no impairment in normal daily functions, 29 felt light impairment, and 16 felt serious impairment. With regard to pollution and the degree of illness, one seriously deteriorating case of bronchial asthma, one deteriorating emphysema, and six improving cases of bronchial asthma were found in heavily polluted areas. One deteriorating case and one improving case of bronchial asthma, and one deteriorating case of chronic bronchitis was found in lightly polluted areas. Compared to 1972 investigations, five cases had improved and four had declined. Spirometric examinations showed improvement in six cases of bronchial asthma, one in chronic bronchitis, and deterioration in five cases of bronchial asthma and one case of bronchitis. There was no significant or clear-cut correlation between the progress of symptoms and the degree of pollution. The selection of areas only by the level of CO was deemed inappropriate, and that other methods including the total area and total pollution picture should be adopted in the future.

1972

42155 **APTIC NO. 64122**

Aronow, Wilbert S., Clifford N. Harris, Michael W. Isbell, Stanley N. Rokaw, and Bruno Imparato

EFFECT OF FREEWAY TRAVEL ON ANGINA PECTORIS. *Ann. Internal Med., 77(5):669-676, Nov. 1972. 14 refs. (Presented at the American College of Chest Physicians, Annual Meeting, Denver, Colo., Oct. 1972.)*

Ten patients with agina pectoris had cardiopulmonary tests in the control state, after being driven for 90 min during heavy morning freeway traffic, and 2 hr after return to determine the effect of carbon monoxide in the automobile exhaust. The cardiac tests were repeated on a subsequent morning, with the patients breathing compressed, purified air during freeway travel. The expired air CO and arterial carboxyhemoglobin levels significantly increased after breathing freeway air. There was a significant decrease in exercise performance until angina, in systolic blood pressure at angina, in heart rate at angina, in systolic blood pressure times heart rate at angina, and in the forced expiratory volume in 1 second/forced vital capacity ratio after breathing freeway air. Ischemic ST-segment depression occurred in three of 10 patients while breathing freeway air. No significant change from control values occurred in the above variables after breathing compressed, purified air. Exposure to heavy freeway traffic increased carboxyhemoglobin levels and caused angina to develop sooner after less cardiac work. (Author abstract modified)

42156 **APTIC NO. 64118**

Ayres, Stephen M., Robert G. Evans, and David Licht

CARBOXYHEMOGLOBINEMIA AND OXYGEN DELIVERY IN NEW YORK CITY TUNNEL WORKERS. *Preprint, American Medical Assoc., 18p., 1972. (Presented at the Air Pollution Medical Research Conference, Chicago, Ill., Oct. 2-3, 1972.)*

A study was made of the effects of automotive pollutants on the health of toll collectors at two tunnels and seven bridges in various parts of New York City. The toll collectors were given pulmonary function tests including forced vital capacity, forced expiratory volume, peak expiratory flow, and maximum midexpiratory flow rate. The toll collectors were also questioned. Average carbon monoxide levels were five times higher at the tunnels than at the bridges, total hydrocarbons were twice as great, nitrogen oxides were three times greater. Carboxyhemoglobin was also measured in the toll collectors. The COHb averaged 2.15% in nonsmoking bridge workers, 2.93% in nonsmoking tunnel workers, 3.82% in smoking bridge workers, and 5% in smoking tunnel workers. A strikingly higher prevalence of abnormal respiratory symptoms was found in the tunnel workers compared to bridge workers in both questionnaire and pulmonary function results.

42157 **APTIC NO. 63613**

Babich, Harvey and Guenther Stotzky

ECOLOGIC RAMIFICATIONS OF AIR POLLUTION. *Society of Automotive Engineers, Inc., New York, Environmental Protection Agency, and Dept. of Transportation, Soc. Automotive Engrs. Int. Conf. Transp. Environ., Proc., Washington, D. C., 1972, Part I, p. 198-214. 181 refs. (May 31-June 2, Paper 720630.)*

Pollutants are emitted into the atmosphere by both industrial and natural processes. Natural processes also remove these pollutants, but, when total emissions exceed the capacity of natural sinks, the quality of the air decreases. Air pollution can damage plants, animals, and microorganisms. It can cause subtle damage to the biosphere, as manifested by growth retardation, acceleration of the aging process, alterations in reproductive potential and genetic constitution, and alterations in host-parasite relations. Pollution may also serve some beneficial roles, such as satisfying some nutrient requirements of plants. Field studies, however, indicate that the environment, in general, is adversely affected by atmospheric pollution. Unfortunately, only speculations on ecologic ramifications of air pollution are possible with the present level of knowledge. Pollutant symptomatology, factors affecting phytotoxicity (such as climate, soil, growth state, and physiological state), invisible injury on plants, synergism between pollutants, effects on reproduction and genetics, adaptation to air pollution, effects on host-parasites, effects on economics, and effects on natural ecosystems are also discussed. (Author abstract modified)

42158 **APTIC NO. 6416**

Bach, Wilfrid, Louis Dickinson, Betsy Weiner, and Gwen Costello

SOME ADVERSE HEALTH EFFECTS DUE TO AIR POLLUTION FROM FIREWORKS. *Hawaii Med. J., 31(6):459-465, Nov.-Dec. 1972. 19 refs.*

The impact on health of high air pollution concentrations from a New Year s fireworks episode was investigated to obtain insight into any causal relationships between air pollution and respiratory diseases. Air pollutants of particle sizes small enough to penetrate deeply into the lungs were measured with a nephelometer. During the fireworks episode, the suspended particulate level in Palolo Valley of Hawaii was at least 20 times above the normal concentration. Relevant meteorological surface and upper air data were obtained. All records from five Honolulu hospital emergency rooms were inspected. Eleven diseases were grouped into chronic respiratory disease and coronary heart disease. The Poisson distribution was used to determine statistically significant differences between the episode and a control period. Chronic respiratory disease among adults more than doubled during the fireworks episode. Variables such as age, sex, social class, smoking habits, changes in total population, weather, volcanic emissions, auto exhausts, pesticides, and pollen were examined and dismissed as factors unlikely to have caused the increased respiratory illness. Alcohol remained as a possible confounding factor, but is presently not considered as an important cause of respiratory disease. Therefore, the very high air pollution levels during the fireworks episode might have been responsible for the higher occurrence of respiratory diseases. Fireworks should be displayed only along the Waikiki coastline to protect a large segment of the Honolulu populace from adverse health effects. (Author abstract modified)

42159 **APTIC NO. 63597**

Brenner, George M. and Duane G. Wenzel

CARBON MONOXIDE AND CULTURED RAT HEART CELLS. I. INHIBITION OF CELL GROWTH AND MAINTENANCE OF BEATING RATE. *Toxicol. Appl. Pharmacol., vol. 23:251-262, 1972. 29 refs.*

Neonatal rat heart cells were separated into cultures which contained mostly endothelioid cells or beating muscle cells. Cultures of each type were exposed to an atmosphere containing 75% carbon monoxide for up to 26 days. Carbon monoxide reduced cellular density, total protein, DNA, and the percentage of viable cells in both types of culture. The beating rate of untreated muscle cell cultures declined, presumably due to endothelioid cell overgrowth. The CO inhibited such overgrowth and prevented the usual time-related reduction in beating rate. It had no apparent direct effect on either the morphology or function of spontaneously beating heart muscle cells. Although the effects of CO on growth or beating rate were not evident until after day 6 of treatment, similar effects of hydrocortisone were seen as early as the second day in culture. The delay in the effect of CO was not related to a change in the cells with time. Carbon monoxide treatment depressed the specific activities of glucose-6-phosphate dehydrogenase and lactic dehydrogenase. The number of lysosomes in muscle cells was reduced by CO. Its effect on lysosomes is proposed as a mechanism for its toxicity. (Author abstract)

42160 **APTIC NO. 64019**

Casarett, L. J.

THE VITAL SACS: ALVEOLAR CLEARANCE MECHANISMS IN INHALATION TOXICOLOGY. *In: Essays in Toxicology. W. J. Hayes, Jr. (ed.), Vol. 3, New York, Academic, 1972, Chapt. 1, p. 1-36. 136 refs.*

Selected gaseous air pollutants are discussed in a review of alveolar clearance. Four gases represent a continuous and continuing exposure to the general public: carbon monoxide, ozone, nitrogen dioxide, and sulfur dioxide. Levels of CO at about 0.04% in the air are usually tolerated for about 1 hr with no readily detectable symptoms, but a level of 0.4% is almost certainly fatal in less than 1 hr. It is not known if CO has a distinct direct chronic effect. The levels of CO tolerated in the lungs of smokers are as great as those found at many sites and suggests that some adaptation occurs as with most of the pollutants. The mechanism of the toxic action of ozone is not fully known, but its oxidative reactivity is a basic ingredient of the effect. Ozone contributes to the effects of the mixture of gases customarily found in polluted urban air. Among the most significant areas of research into NO2 are studies on the peroxidation of pulmonary lipids by NO2 analogous to changes suggested for O3 and investigations relation NO2 exposure to physiological and pathological responses consonant with pulmonary emphysema. There have been extensive studies on SO2 in animals and man with special emphasis on the immediate physiologic responses to pulmonary irritation. Sulfur dioxide has been studied separately and in combination with aerosols.

42161 **APTIC NO. 63580**

Chow, C. K. and A. L. Tappel

AN ENZYMATIC PROTECTIVE MECHANISM AGAINST LIPID PEROXIDATION DAMAGE TO LUNGS OF OZONE-EXPOSED RATS. *Lipids, 7(8):5-8-566, Aug. 1972. 22 refs.*

The effects of whole animal exposure to ozone and of dietary alpha-tocopherol on the occurrence in rat lungs of lipid peroxidation and alteration of the activity of enzymes important in detoxification of lipid peroxides were investigated. Exposure to 0.7 and 0.8 ppm O3 continuously for 5 and 7 days respectively, significantly elevated the concentration of thiobarbituric acid (TBA) reactants, primarily malonaldehyde, produced by lipid peroxidation, as well as the activities of glutathione (GSH) peroxidase, GSH reductase, and glucose-6- phosphate (G-6-P) dehydrogenase. As a logarithmic function of dietary alpha-tocopherol, the increase in formation of malonaldehyde and the increase in activities of GSH peroxidase and G-6-P dehydrogenase were partially inhibited. The activity of GSH reductase was not affected by dietary alpha-tocopherol. The concentration of malonaldehyde and the activity of GSH peroxidase in lung were linearly correlated. The occurrence of lipid peroxidation in the lung during ozone exposure revealed an enzymatic mechanism against damage. An apparent compensation mechanism is that with increased lipid peroxides there is increased activity of GSH peroxidase, which in turn increases lipid peroxide catabolism. (Author abstract modified)

42162 **APTIC NO. 64085**

Felton, Jean S., Ephraim Kahn, Bernard Salick, Fred C. Van Natta, and Michael W. Whitehouse

HEAVY METAL POISONING: MERCURY AND LEAD. *Ann. Internal Med., vol. 76:779-792,, 1972. 38 refs. (Presented at the University of California Conference, Los Angeles.)*

The addition of mercury and lead to the list of environmental pollutants caused an examination of these materials in industry and a consideration of the relationship of bioassay levels to clinical systems and the mechanisms of heavy metal poisoning. Mining and mercury use have been continuous for over 2000 years, and in the last several decades it has been outlawed from some industrial uses. Concern over organic mercury compounds has replaced former interest in the elemental metal. Absorption of these metals from various sources is causing metal poisoning. The clinical patterns are multiple, and current laboratory tests confirm the increased absorption by persons exposed. Epidemiological surveys have established levels of mercury and lead in air and water, and pharmacologists have identified the systems of tissue binding. Therapeutic methods do exist for lowering the body burden of both mercury and lead. The biochemistry of heavy metal toxicity is discussed including metal-ligand interactions and methyl mercury. (Author abstract modified)

42163 **APTIC NO. 63534**

Firth, J. Naylor M.

MINERALOGICAL DISTRIBUTIONS AND DISEASE PATTERNS IN THE SOUTH WALES COALFIELD. *Missouri Univ., Columbia, Environmental Trace Substance Center and Extension Div., Trace Subst. Environ. Health, Proc. Univ. Mo. Annu. Conf., 6th, Columbia, Mo., 1972, p. 325-331. 20 refs. (June 13-15.)*

Sulfide mineralization with lead, zinc, copper, and nickel is found in a zonal arrangement in the South Wales coalfield. The zones coincide with the isovolatile zones of the coal seams, and both mineralization and coalification are thought to have a common origin in magmatic material at shallow depth. The incidence of pneumoconiosis and central nervous system malformations also follow a similar regional pattern. A research program to study the cause of pneumoconiosis in coal miners in South Wales revealed the presence of secondary quartz in the anthracite belt as a possible source, and the incidence increased as the rank of the coal changed from bituminous to high-grade anthracite. Further medical research into patterns of pneumoconiosis, c.n.s. malformations, and other localized high-incidence conditions should be undertaken in close cooperation with parallel environmental research.

42164 **APTIC NO. 63718**

Hashimoto, K. and K. Ando

A STUDY ON THE DISTRIBUTION OF RADIO-LABELLED 14CO IN THE LIVING BODY. *(Hoshasei issanka tanso (14CO) no seitai bunpu ni kansuru kenkyu). Text in Japanese. Osaka Furitsu Koshu Eisei Kenkyusho Kenkyu Hokoku, Rodo Eisei-hen (Proc. Osaka Public Health Inst., Ed. Ind. Health), vol. 10:1-5, Sept. 1972. 13 refs.*

Male ICR-JCL mice of 6-8 wk were exposed after birth to C-14 carbon monoxide to 50 ppm of (specific activity of 40 mCi/mmol, radioactive purity of 99.9%) for 6 hr. Its distribution in the body of the mouse was traced to obtain the following results: just after the exposure, the content of COHb was 4.6% the content of 14CO from 45 min to 3 hr after the termination of the exposure was highest in blood, followed by that in the heart and then by that in brain tissue; while 14CO became undetectable in blood after 6 hr of the termination of the exposure, that in the heart and brain tissue became undetectable after 3 hr; in other organs 14CO became undetectable after 45 min of the termination of the exposure; and the affinity of 14CO to the heart and to the brain tissue shown by the present experiment could not be totally explained by the high content of myoglobin or cytochrome in these organ.

42165 **APTIC NO. 61072**

Huebscher, J., N. Presselt, K. -J. Halbhuber, and G. Geyer

AUTORADIOGRAPHIC INVESTIGATIONS OF THE DISTRIBUTION OF SOME METAL ISOTOPES IN THE ORGANS OF WISTAR RATS. A CONTRIBUTION ON METAL EXCRETION. *(Autoradiographische Untersuchungen ueber die Verteilung einiger Metallisotope in Organen von Wistar-Ratten. Ein Beitrag zur Metallausscheidung). Z. Mikroskop. Anat. Forsch., 86(4):553-559, 1972. 14 refs. Translated from German, 9p.*

The uptake of zinc-65, mercury-203, and lead-210 was studied autoradiographically in various organs of Wistar rats. Paneth cells, the prostate gland, exocrine cells of the pancreas, the islets of Langerhans, and hair bulbs were labelled with 65Zn, 203Hg, or 210Pb, three to four hours after intraperitoneal injection of the metal isotopes. Brain, retina, and mast cells remained unlabelled. Reduction of pathologically high metal concentrations in the rat occurs with the help of exocrine glandular cells, with the metal ions apparently being taken up actively by the cells and bound unspecifically to glandular secretions. (Author summary modified)

42166 **APTIC NO. 64279**

Jirak, Zdenek, Alois Andel, and Jaroslav Volf

DEVICE FOR VENTILOMETRY AND INDIRECT CALORIMETRY USING THE WRIGHT RESPIROMETER. *(Zarizeni pro ventilometrii a neprimou kalorimetrii za pouziti Wrightova respirometru). Text in Czech. Pracovni Lekar (Prague), 24(1):18-22, 1972. 8 refs.*

A simple device was developed for ventilometry with indirect calorimetry using the Wright respirometer type 371627 with the possibility of air sampling for analysis. The device consists of a half-mask with two inhaling valves and one exhaling valve, a socket in the center of which is the sensing element of the thermometer, a mixing sac of 5-liter volume with an exhaling valve, and a miniature membrane pump propelled by a battery. For normal field examinations, the simplified respirometer without the pump is sufficient. The air sample for analysis is collected during expiration through a jet from the space of the half-mask and the results are corrected according to the equations: oxygen % equals 0.4232 + 0.8915x where r equals 0.958 and carbon dioxide % equals 0.5704 + 0.8647x where r equals 0.965. The respirometer was calibrated on eight persons at submaximal loads on the bicycle ergometer (52 measurements). The linear relation between the volume of expired air and the data by the respirometer may be expressed by the equation: minute ventilation equals -0.4809 + 0.9230x where r equals 0.9915. The resistances of respiration were measured in continuous and in discontinuous air flow. Up to 100 l/min, the respiratory resistances were lower than in the devices used so far. At an air flow of more than 125 l/min, the resistance of expiration increased more steeply than in the gasmeter. The device was satisfactory under field and laboratory conditions in ventilometry and indirect calorimetry in light and medium heavy work up to 8 kcal/min.

42167 **APTIC NO. 64103**

Lavenne, F. and A. Minette

EXOGENOUS FACTORS IN THE ETIOLOGY OF CHRONIC BRONCHITIS. *(Les facteurs exogenes dans l'etiologie de la bronchite chronique). Text in French. Vie Med. Can. Fr., vol. 1:566-571, June 1972.*

The exogeneous factors in the etiology of chronic bronchitis, such as cigarette smoking, climate, and industrial irritants are discussed. Smoking affects coughing and expectoration, and age and sex play a role in dyspnea. Climatic and meteorological factors are also important. Most patients attribute their bronchitis attacks to inhalation of cold air (35%); 30% to humidity in the air; and 10% to fog. The highest mortality was registered in England during December to March, i.e., 6,381 as compared to 11,365/yr. The urban factors, such as atmospheric pollution, leading to barometric inversions, which cause stagnant fogs, lead to a higher morbidity of bronchitis. The hospitalization incidence for cases of bronchitis in Holland was directly proportional to the content of sulfur dioxide in the air and the winter fogs. Sulfur dioxide is a direct agent causing chronic bronchitis. The third main factor affecting the incidence of bronchitis is occupational.

42168 **APTIC NO. 65002**

Mappes, R.

ON THE QUESTION OF THE MIK AND MAK VALUES FOR LEAD. *In: Lead and Environment 1972. West German Federal Ministry of Health, Commission for Environmental Dangers Lead Working Group. Translated from German, p. 105-107, 1972.*

Average lead concentrations in respiratory air at a battery factory were measured weekly along with the testing of urine in workers for aminolevulinic acid and coproporphyrin in an investigation of the appropriateness of maximum emission concentrations and maximum air concentrations. The results led to confirmation of the MAK value between 0.15 and 0.2 mg Pb/cu m and indicated no noteworthy response of the urinalysis indicators at working sites with mean lead concentrations of 20-100 micrograms Pb/cu m.

42169 **APTIC NO. 64087**

Mauderly, J. L.

STEADY-STATE CARBON MONOXIDE-DIFFUSING CAPACITY OF UNANESTHETIZED BEAGLE DOGS. *Am. J. Vet. Res., vol. 33:1485-1491, 1972. 26 refs.*

A steady-state carbon monoxide method for measuring pulmonary diffusing capacity (D sub L CO) was adapted for use with unanesthetized dogs. The test utilized end tidal alveolar gas samples collected by an automatic device actuated by changes in intraesophageal pressure. The mean D sub L CO obtained by single measurements on 49 beagle dogs fell within the limits of reported means obtained from spontaneously breathing dogs by other methods. The ranges for D sub L CO obtained by repeated measurements on individual dogs were approximately one-half as large as the range resulting from single measurements on 49 dogs. The individual variability in the pulmonary diffusing capacity of unanesthetized dogs was greater than that reported for dogs under anesthesia. Arterial-end tidal alveolar and arterial blood tensions of carbon dioxide were compared in 10 dogs. The differences obtained with the end tidal sampler were similar to reported values obtained by different methods. (Author summary modified)

42170 **APTIC NO. 64220**

Nisbet, I. C. T.

ENVIRONMENTAL OCCURRENCE AND HUMAN EXPOSURE. *Environ. Res., 5(3):287-308, Sept. 1972.*

Available measurements of the amount of polychlorinated biphenyls (PCBs) in animals and human food are compared to estimates of cumulative PCB input into the environment. Most surveys have been taken of PCB in fish and birds, with few measurements in air and water. The only numerical measurements of PCB levels in air are estimates of total suspended particulates in four U. S. cities between 1968 and 1970. The mean level of PCBs was 50 ppm, which is consistent with estimates based on rates of transport in the environment. A total fallout of 78 micrograms/sq m PCB was measured in Sweden, which corresponds to an estimated continent- wide mean rate of fallout of 40-80 micrograms/sq m/yr. Aquatic animals and fish accumulate PCBs to levels of the order of 10,000 times higher than those in the ambient water. It is not yet clear whether predatory fish accumulate PCBs to levels consistently higher than those in their food. However, PCBs are accumulated within aquatic food chains involving birds and mammals by factors of the order of 10-100 at each step. The PCB and DDT residues accumulate to a similar extent in food chains. Hence the ratio DDT/PCB in animals can be used as a rough measure of the ratio in the substrate. Measurements in aquatic animals are consistent with the model estimating buildup in the environment for localized contamination of water near industrial areas plus low- level general contamination. Except for sporadic instances of contamination, most PCBs in human diets are from fish. The mean level in pooled food samples in the U. S. is roughly four times lower than that of DDT residues. Intake from locally caught or noncommercial fish may be much higher at times, however. Breast- fed infants probably have a relatively high intake of PCBs. No data are available for which to assess the importance of occupational or semioccupational exposure to PCBs. Average levels in human fat, milk, and blood plasma in the U. S. population are somewhat lower than those of DDT residues, but a new extremely high levels have been reported. It is not yet possible to interpret patterns of variation in PCB levels in man. (Author summary modified)

42171 **APTIC NO. 63535**

Nord, Peter J. and Eula Bingham

BIOLOGICAL AVAILABILITY OF CERTAIN METALS IN COAL. *Missouri Univ., Columbia, Environmental Trace Substances Center and Extension Div., Trace Subst. Environ. Health, Proc. Univ. Mo. Annu. Conf., 6th, Columbia, Mo., 1972, p. 341-345. 6 refs. (June 13-15.)*

As part of an investigation of the factors important in the development of coal worker pneumoconiosis, the biological availability of certain metals from coal was investigated. The National Institute of Occupational Safety and Health provided micronized coal samples from two different mining areas. One sample (Mine No. 1) is from an area of high prevalence of coal workers pneumoconiosis and the other sample (Mine No. 2) is from an area with little disease. The two coal samples differed markedly in content of metals and other compounds. Notable differences were found in the content of free silica, lead, nickel and chromium. In an effort to determine the biological availability of certain metals, samples of coal were mixed with serum, lung washings (LW), and saline. The mixtures were held at room temperature or 37 C for various periods up to 2 wk. The coal particles were removed from the fluids by filtration and centrifugation. Analysis of the fluids for content of certain metals was by atomic absorption spectroscopy. Saline and LW eluted about 70% of the nickel contained in the coal from Mine No. 1 (total nickel 1000 micrograms/g coal) in 24 hr, whereas only 5% was eluted by the serum in 24 hr. After 5 days the quantity of nickel eluted was almost 100% (by the serum). The quantity eluted by LW and saline was approximately 75% after 5 days. The elution of nickel from the other coal sample (Mine No. 2 total nickel 108 micrograms/g coal) was slower. The serum eluted 15% of the nickel after 3 days and 80% after 10 days. The LW and saline did not elute nickel from the sample after 5 days.

42172 **APTIC NO. 63551**

Pooley, F. D.

ELECTRON MICROSCOPE CHARACTERISTICS OF INHALED CRYSOTILE ASBESTOS FIBRE. *Brit. J. Ind. Med. (London), vol. 29:146-153, 1972. 14 refs.*

Specimens from 300 lungs were examined under the electron microscope to determine the morphology and diffraction characteristics of any chrysotile asbestos they contained. In 120 cases, material was prepared by alkali digestion, and the residual dust was examined. In all cases, standard 6-micron histological slides were partially ashed before the residue was transferred to the electron microscope grids. Of the 300 specimens examined, 20 came from men with prolonged industrial exposure to chrysotile, 87 from cases of mesothelioma, and the remainder from control groups drawn from rural and industrial populations. Chrysotile fibers were readily identified by the characteristic polycrystalline diffraction pattern. The hollow appearance of the single fibers and their shape and arrangement also helped in the identification. Specimens from men without industrial exposure contained either single short fibers or aggregates scattered throughout the lungs. In specimens from industrially exposed men, fibers were very numerous and were strands of single fibers mainly grouped together in discrete locations. Ferruginous bodies were found rarely, and only on straight fiber bundles of over several micron in length. (Author abstract)

42173 **APTIC NO. 65003**

Schlegel, H., G. Kufner, and H. Leinberger

THE PRACTICE OF LEAD-DAMAGE PREVENTION IN THE METAL-WORKING INDUSTRY. *In: Lead and Environment 1972. West German Federal Ministry of Health, Commission for Environmental Dangers Lead Working Group. Translated from German, p. 111-130, 1972. 14 refs.*

Lead poisoning prevention in the metal working industry is discussed in terms of various diagnostic tests. Spectrophotometric determination of delta-aminolevulinic acid in the urine, quantitative determination of coproporphyrin III in the urine, and analysis of free erythrocyte protoporphyrin increase are reviewed in terms of diagnostic effectiveness and material costs per sampling. Testing procedures are given for each of the methods. Disrupted heme synthesis was found in every case of clinically symptomless elevated lead absorption with increased delta-aminolevulinic acid and coproporphyrin elimination, often as long as 1 year and longer after the normalization of the other two parameters.

42174 **APTIC NO. 64338**

Schuckmann, Fritz

POSSIBILITIES OF DIAGNOSIS AND PROPHYLACTIC MEASURES AGAINST CHRONIC BENZENE DAMAGE. *(Moeglichkeiten der Diagnostik und Prophylaxe des chronischen Benzolschadens). Text in German. Zbl. Arbeitsmed., 22(10):294-300, 1972. 55 refs.*

About half of the West German production of benzene is used as an additive to automobile gasolines. The inhaled benzene tends to accumulate in the fatty tissue as a consequence of its lipoid solubility, and is also stored in the central nervous system, the liver, and the bone marrow. For determination of the effect of benzne inhalation a number of animal experiments were conducted over the past 10 yrs. A review of animal experiments found in the literature is given. The most interesting data were obtained with 40 rats which inhaled over a period of 6 to 31 wk variouus benzene concentrations. The animals inhaled the concentrations 5 hr/day 4 days/wk. With 831, 65 and 61 ppm the blood composition changed significantly after 2 to 4 wk with 47 and 44 ppm moderate changes without significance were found after 5 to 8 wk. With 31, 29 and 25 ppm after 4 to 7 mo. In other experiments reflex disturbances were observed with rats exposed to 20 ppm which were still observed with a concentration if 4 ppm of diagnosis and prophylaxis are discussed.

42175 **APTIC NO. 61070**

Shvayko, I. I. and I. N. Tsvetkova

INFLUENCE OF VARIOUS DOSES OF COBALT, NICKEL AND THEIR COMBINATIONS ON THE FUNCTION OF THE THYROID GLAND IN THE RAT. *(Vliyaniye Raznykh Doz Kobal ta, Nikelya i Ikh Kombinatsiy na Funktsiyu Shchitovidnoy Zhelezy u Krys). Mikroelem. Med., vol. 3:210-212, 1972. Translated from Russian, 4p.*

Radioiodine and gas exchange measurements are used to study the influence of various doses of cobalt, nickel and their combinations on the function of the thyroid gland in the rat. Small doses of cobalt and nickel, within the limits of 1 mg/kg of weight per day, inhibit the concentration capacity of the thyroid gland with respect to radioiodine, while large doses (25 mg of nickel and 10 mg of cobalt) result in an increase in radioiodine absorption by 1.5 to 2 times that of controls. Oxygen consumption increases in rats receiving small doses of the trace elements and decreases in rats receiving large doses of cobalt and nickel.

42176 **APTIC NO. 64157**

Valic, F. and E. Zuskin

EFFECTS OF DIFFERENT VEGETABLE DUST EXPOSURES. *Brit. J. Ind. Med. (London), vol. 29:293-297, 1972. 4 refs.*

In order to establish the rank of biological activity of vegetable dusts, five groups of nonsmoking female workers exposed to similar concentrations of hemp, flax, cotton, sisal, and jute airborne dust were compared as to the prevalence of byssinosis chronic respiratory symptoms, and 1-second expiratory volume changes over the Monday shift. The groups were selected in such a way as to differ in the distribution of age and length of exposure to the respective dust as little as possible. The prevalence of byssinosis in hemp and flax was approximately equal (44% and 43%, respectively); in cotton workers it was considerably lower (27%); and no byssinosis was caused by either sisal or jute dust. The highest prevalence of other chronic respiratory symptoms was recorded in hemp workers (39%), followed by flax (36%) and cotton (27%) workers, while in sisal (13%) and jute (13%) workers it was the lowest. Significant mean forced expiratory volume reductions over the shift were recorded in all the groups of textile workers, with the largest reductions in hemp workers (19%), followed by flax (11%), cotton (8%), sisal (7%), and jute (5%) workers. The application of the bronchodilator orciprenaline before the shift diminished the mean acute forced expiratory volume falls over the work shift in all the groups studied. (Author abstract)

42177 **APTIC NO. 63592**

Whitehead, T. P.

GENERAL DISCUSSION. *Inst. of Petroleum, London (England); Chemical Society (England); and British Occupational Hygiene Society (England), Lead Environ., Proc. Conf., London, England, 1972, p. 61-82. 22 refs.*

A general discussion is given on the measurement of lead in the air sources of lead including gasoline, and effects of lead on the human body. Seasonal variations in air lead concentrations are mentioned. Methods of analyzing lead in the air, threshold limit values, sources of lead, the need for lead alkyls in motor fuels, and physical characteristics of lead alkyls are discussed. The effects of lead on the health of persons in urban areas, the lead load in children, the effects of lead from gasoline combustion on humans, the absorption and retention of lead in humans, and blood and urinary lead concentrations in occupationally exposed and unexposed persons are also discussed.

42178 **APTIC NO. 64020**

Yobs, Anne R.

POLYCHLORINATED BIPHENYL LEVELS IN HUMANS. *Preprint, Environmental Protection Agency, Chamblee, Ga., Office of Pesticides Program, 11p., 1972 (?). 6 refs.*

Preliminary results from a monitoring program are presented involving the presence of polychlorinated biphenyls stored in human adipose tissue. Samples are collected from both sexes in all age and racial groups. An analytical method is described by which PCBs are separated from pesticides to improve the accuracy of quantitation of pesticides and to conform PCB levels. Samples in this study are taken from tissues removed for therapeutic surgery or from postmortem operations. Distribution between the positive and negative groups for sex, race, or diagnosis does not appear to be significant. However, statistical evaluation has not yet been performed. Positive samples were obtained from every state sampled, with the highest levels being 16 ppm. In spite of the larger number of samples, the distribution of PCB levels has shown only slight change with small increase in the percentage of samples falling in the 1-2 ppm and greater than 2 ppm ranges.

42179 **APTIC NO. 64102**

Zamfir, Gheorghe

AIR POLLUTION AND BRONCHOPULMONARY CANCER. *(Poluarea aerului si cancerul bronhopulmonar). Text in Rumanian. Rev. Med.-Chir., 76(2):273-280, April-June, 1972.*

The influence of air pollution on the incidence of bronchopulmonary cancer is discussed. Air pollution generated by industry, transportation, noise, traffic accidents, and irritant and stress stimuli, can cause neuropsychic, hormonal, and somatic changes. Pollutants generated by industry and motor vehicles, which contain carcinogenic substances have increased the incidence of pulmonary tumors, chronic bronchitis, and emphysema. Statistics from England and Wales indicate an increased mortality rate of patients with pulmonary cancer between 1950 and 1953. The most common of the carcinogen substances are polycyclic hydrocarbons resulting from incomplete combustion in industry, domestic heating, and motor vehicles.

42180 **APTIC NO. 63561**

Zarkovic, Grujica

ETIOLOGY OF NON-SPECIFIC CHRONIC RESPIRATORY ILLNESS AND COR PULMONALE IN BOSNIA AND HERCEGOVINA. *Int. J. Epidemiol., 1(2):167-176, 1972. 7 refs.*

A random survey of 12,000 adults and 10,000 schoolchildren was undertaken in Bosnia and Hercegovina to investigate the etiology of non-specific chronic respiratory illness and cor pulmonale. Differences in the prevalence rates of chronic bronchitis and cor pulmonale were statistically significant for age, sex, and geographical region. Prevalence was highest in rural areas of central Bosnia and lowest in rural regions of Hercegovina. A very high association of cor pulmonale, lung emphysema, and chronic bronchitis existed with obstruction of the upper respiratory airways. Smokers had higher prevalence rates than non-smokers. The rural population in Bosnia experienced more respiratory illness than even the urban population of towns notorious for having the highest degree of air pollution in Yugoslavia. A slight association of the prevalence of respiratory illness existed with occupational dust exposure, average annual temperature, and altitude above sea level; but these differences were compatible with the geographic differences between the two regions. Smoking habits and other environmental variables were concluded as insufficient for entirely explaining the geographic differences found in the prevalence of chronic bronchitis and cor pulmonale. (Author abstract modified)

42181 **APTIC NO. 64135**

Zikria, Bashir A., Jose M. Ferrer, and Howard F. Floch

THE CHEMICAL FACTORS CONTRIBUTING TO PULMONARY DAMAGE IN SMOKE POISONING. *Surgery, 71(5):704-709, May 1972. 14 refs. (Presented at the American Burn Association Annual Meeting, 3rd, San Antonio, Tex., April 16, 1971.)*

The chemical analysis of smoke from wood and kerosene is compared and the pathophysiology of smoke is discussed. Thirteen dogs were exposed for 20 to 30 min to kerosene smoke and 14 dogs were exposed for 10-20 min to wood smoke. Wood smoke exposure produced significant pulmonary pathologic changes, but kerosene smoke did not. There are two basic quantitative differences between the two smokes. The wood smoke contained 2.5% by volume carbon monoxide compared to 0.20% by volume of CO in kerosene smoke. There was an incidence of CO poisoning among the dogs exposed to wood smoke, with a maximum level of carboxyhemoglobin in these animals of 65%. The total aldehydes in wood smoke was 0.11% by volume compared to 0.0007% in kerosene smoke. The aldehyde gases resulted from the combustion of household materials. The most toxic of the aldehydes is acrolein, a three carbon compound for which the maximum allowable concentration in industry if 0.1 ppm. Acrolein was present in wood smoke in a concentration 50 times that found in the kerosene smoke and 500 times the industrial maximum allowable concentration.

42182 **APTIC NO. 63749**

Tokyo Metropolitan Government (Japan), Meguro District Dept. of Construction Pollution

THE 1971 POLLUTION SURVEY REPORT. *(Kogai chosa hokokusho). Text in Japanese. 88p., Oct. 1972.*

The effects of air and water pollution on human health were investigated in the Meguro District of Tokyo in September, November, 1971 and January 1972. Four areas in the districts with the CO concentrations of 18.7, 15.2, 7.2 and 7.9 ppm respectively were selected, and 22 patients residing in these areas who had bronchial asthma, emphysema, chronic bronchitis, and lung cancer were examined by a team of physicians from 11 health service organizations and the patients personal physicians. There were 40 prolonged studies. The subjective symptoms impairment of daily life, appetite, sleep, breathing difficulty, coughs, sputum, and the objective symptoms cyanosis, anemia, swollen fingers, blood pressure, urinalysis, hematological examination, chest X-rays, and spirometry were examined. No differences were noted between mean and women. The older residents seemed to have more emphysema and the younger ones more bronchial asthma. In the area with a concentration of 18.7 ppm, emphysema cases were concentrated, but the relationship with air pollution was not confirmed. Correlations were recognized among subjective and objective symptoms and clinical examinations. Some improving and some deteriorating cases were found, but most improving cases were bronchial asthma, and deteriorating cases were emphysema.

42183 **APTIC NO. 63997**

ADAPTATION TO SMOG AND CARBON MONOXIDE. *In: Patterns and Perspectives in Environmental Science. p. 385-390, 1972.*
GPO

Smog, generally meaning the totality of community air pollution, is studied as to its effect on health, in particular the respiratory system. Smog refers to sulfur dioxide and particulate pollution, occurring chiefly in coal-burning areas, and to photochemical air pollution. Man is exposed to carbon monoxide in cigarette smoking, in occupational exposures to combustion products, in connection with community air pollution, in confined areas contaminated by motor-vehicle exhaust, and when household cooking and heating appliances are not adequately vented. Air pollution exposures do not generally cause a specific disease, but rather contribute to the aggravation, and possibly to the causes, of several possible diseases. The main target for smog is the respiratory system, and for carbon monoxide, the circulatory system. Various experiments are cited to support these contentions. Nitrogen dioxide is related to emphysema. Carbon monoxide drastically interferes with the metabolism of the heart muscle, shifting it from an oxidative to a less efficient form of metabolism. Ozone has been shown to increase pulmonary fibrosis in small animals when there is long-term exposure. The case fatality rate among persons admitted to Los Angeles hospitals was increased due to the possible effect of carbon monoxide exposure.

42184 **APTIC NO. 64037**

National Heart and Lung Inst., Task Force on Research in Respiratory Diseases, Bethesda, Md.

HYPERSENSITIVITY PNEUMONITIS (FINAL REPORT). *In: Respiratory Diseases. Task Force Report on Problems, Research Approaches, Needs. Dept. of Health, Education, and Welfare Rept. (NIH) 7-432, p. 87-100, Oct. 1972. 22 refs.*

Hypersensitivity pneumonitis (extrinsic allergic alveolitis), a diffuse interstitial granulomatous lung disease due to an allergic reaction following inhalation of a specific organic dust, is reviewed in terms of the magnitude of the problem and the current state of knowledge concerning natural history, pathogenesis, host factors, and environmental factors. The basic mechanisms that underlie the development of pulmonary hypersensitivity diseases following inhalation of antigens are not understood, and at present recurrent attacks can only be prevented by avoidance of exposure to specific antigens. While many antigens causing hypersensitivity pneumonitis have been identified, the factors and events required for an immunogenic response and the mechanism by which pulmonary lesions are produced are still unknown. Procedures are available for screening suspected dusts for antigen content, but final identification rests on close observation of the patient when exposed to the suspected environment, and in some instances provocative challenge by the antigen is necessary for definitive diagnosis. Studies on the natural history of hypersensitivity pneumonitis are necessary for more effective diagnosis and treatment.

1971

42185 **APTIC NO. 64278**

Bruin, A. de

CERTAIN BIOLOGICAL EFFECTS OF LEAD UPON THE ANIMAL ORGANISM. *Arch. Environ. Health, vol. 23:249-264, Oct. 1971. 174 refs. (Presented at the Conference on Inorganic Lead, Amsterdam, Netherlands, Nov. 28, 1968.)*

Scientific literature is reviewed on the biological, biochemical, and toxic phenomena which result from the absorption of lead in in measurable quantities into the bodies of animals and men. The extent to which the quantitative measurement of certain of these reactions to the absorption of lead might be used to recognize the likelihood of the occurrence of clinical lead poisoning in time to prevent its occurrence is indicated. Of greater importance is the demonstration of the multiplicity of effects which sufficient concentrations of lead may induce in the biochemistry and physiology of animals. The influence of lead on hematopoiesis, the influence of lead on circulating erythrocytes, the mechanism of the biosynthesis of heme, and the stimulation of erythropoietic activity are discussed. Certain biological reactions evidencing increased lead absorption rates are discussed including increased basophilic stippled cells, increased coproporphyrin concentration in urine and certain tissues, increased numbers of reticulocytes in the blood, increased quantities of protoporphyrin 9 in erythrocytes, increased aminoketones in urine and blood (such as delta-aminolevulinic acid), disturbances of iron metabolism in hemoglobin formation, inhibition of delta-aminolevulinic dehydratase, and inhibition of heme synthetase. Miscellaneous biochemical reactions to lead absorption are also discussed including activities of enzymes, modification of proteins in blood serum, renal impairment and excretion of amino acids, shifts in metallic components of tissues and body fluids, excretion of steroids in urine, effects on iodine metabolism, decreased coagulation of blood, reaction of lead with certain chemical groups such as sulfhydryl and thiol groups, influences on human immunologic responses, influences upon mucopolysaccharides in blood, effects on hemoglobin, influences on urinary concentration of 5-hydroxyindoleacetic acid, effects on nicotinic acid, and influences on lipid metabolism. (Author abstract modified)

42186 **APTIC NO. 64082**

Champion, Paul

TWO CASES OF MALIGNANT MESOTHELIOMA AFTER EXPOSURE TO ASBESTOS. *Am. Rev. Respirat. Disease, 103(6):821-826, 1971. 14 refs.*

Repeated exposure to asbestos dust leads to a number of diseases such as asbestosis, carcinoma of the bronchus, and malignant tumors of the pleura and peritoneum. Two cases of malignant mesothelioma of the pleura are described that illustrate certain unusual features of their causes. The first case was a 31-year-old man who worked as a cable maker and a die caster. He had never been occupationally exposed to asbestos dust, but had worked with aluminum sprays and arsenic compounds, and he smoked 20 cigarettes/day for 16 years. The patient s father had asbestosis due to exposure to asbestos as a pipe lagger. The patient, his mother, and his siblings were exposed to asbestos from contact with the father and his clothing. The mother had emphysema and the sister had a calcified pleural plaque. Pleural plaques were of diagnostic importance. In the second case of a 32-year-old man, the patient lived for 23 years in an asbestos mining town and worked for 10 years as an asbestos mine prospector. He was a moderately heavy smoker. Chrysotile asbestos was probably the carcinogen involved in his development of mesothelioma. The importance of clinical and radiographic observation of those in personal contact with workers in the asbestos industry and the important part played by all types of asbestos dust in the production of malignancy are discussed. (Author summary modified)

42187 **APTIC NO. 63589**

Gajdos, A. and M. Gajdos-Torok

DELTA-AMINOLEVULINIC ACID SYNTHETASE AND ADENOSINE TRIPHOSPHATE ACTIVITY IN ACUTE SATURNINE INTOXICATION IN RABBITS. *Arch. Environ. Health, vol. 23:270-274, Oct. 1971. 15 refs. (Presented at the Conference on Inorganic Lead, Amsterdam, Netherlands, Nov. 28, 1968.)*

Lead acetate at a dosage of 100 mg/kg of body weight was injected intraperitoneally into rabbits. The activity of delta-aminolevulinic acid synthetase in the mitochondria isolated from liver and bone marrow specimens of the exposed rabbits remained within normal limits. The concentration of adenosine triphosphate in the liver was also normal. The concentration of this nucleotide in circulating erythrocytes was moderately (significantly) increased. These findings support the view that the biosynthesis of porphyrins is not enhanced during intoxication by lead, but that utilization of porphyrins and their precursors is diminished by reduction in activity of heme synthetase. (Author abstract modified)

42188 **APTIC NO. 64052**

Hislop, J. S. and A. Parker

LEAD IN HUMAN TISSUE: A LITERATURE SURVEY WITH PARTICULAR REFERENCE TO THE DETERMINATION OF LEAD IN HUMAN RIB. *United Kingdom Atomic Energy Authority Research Group, Harwell (England), Analytical Sciences Div., Rept. HL 71/5979 (C2), 22p., Dec. 1971. 88 refs.*

NTIS: AERE-R 6987

Levels of lead in hard and soft tissues in the human body are surveyed together with the distribution of Pb in the skeleton. The concentration of Pb in soft tissue is less than in hard tissue and residence times are shorter. The liver (0.4-2.8 ppm fresh wt) and kidneys (0.15-1.6 ppm fresh wt) have the highest concentrations, although muscle is also high (0.1-1.7 ppm fresh wt). The Pb concentrations of the ash from these tissues will be approximately 100 times greater. The whole blood Pb level is approximately 0.2-0.4 ppm for normal, unexposed persons. Concentrations approaching 0.8 ppm are generally accompanied by symptoms of plumbism. Both stable Pb and 210 Pb is concentrated in the skeleton, although a figure as high as 90% has been quoted. The chemical form of Pb and factors affecting its concentration in bone are discussed as well as methods for the destruction of organic matter present in this matrix. A survey of analytical methods which have been used or which show potential for the determination of Pb is made. (Author abstract modified)

42189 **APTIC NO. 63591**

Malcolm, Dennis

PREVENTION OF LONG-TERM SEQUELAE FOLLOWING THE ABSORPTION OF LEAD. *Arch. Environ. Health, vol. 23:292-298, Oct. 1971. 28 refs. (Presented at the Conference on Inorganic Lead, Amsterdam, Netherlands, Nov. 28, 1968.)*

The initiation in 1927 of modern measures of environmental control and medical supervision has reduced greatly the severity of exposure of employees of a storage battery factory to lead and has eliminated the occurrence of frank lead poisoning. An attempt was made to determine the extent to which the chronic effects of low-grade lead exposure has been prevented by comparing the mortality and incidence of vascular hypertension and fatal cerebrovascular accidents among retired and currently employed persons with that of employees of a much later period during which in-plant exposure to lead had been reduced to levels now considered safe. The data suggests that such effects were prevented. Prior to 1927, air lead concentrations often exceeded 0.5 mg/cu m; after 1927, the air lead level decreased to approximately 0.15 mg/l. (Author abstract modified)

42190 **APTIC NO. 64182**

Shugayev, B. B.

TOXICITY OF ALIPHATIC HYDROCARBONS - BASIC PRODUCTS OF THE PETROLEUM REFINING AND PETROCHEMICAL INDUSTRIES. *(Toksichnost alifaticheskikh uglevodorodov - osnovnykh produktov neftepererabatyvayushchikh i neftekhimicheskikh proizvodstv). Text in Russian. Toksikol. Gig. Prod. Neftekhim. Neftekhim. Proizvod., Vses. Konf. 2nd, 1971, p. 3-26. 86 refs.*

Studies on the acute and chronic toxicity and the toxic effects of aliphatic hydrocarbons as occur in the air and other media in the petroleum refining and petrochemical industries are reviewed. Comprehensive toxicological data derived from animal tests and clinical observations on subjects poisoned with aliphatic hydrocarbons indiate the moderate toxicity of these compounds, and moderate to low toxicity of the olefin and paraffin series in inhalative exposure. The toxicity of aliphatic hydrocarbons is 5 to 10 times lower than that of corresponding aromatic compounds. Low concentrations of aliphatic hydrocarbons as occur in the air in the petroleum refining and petrochemical industries are characterized by nonspecific toxicity. Distinct phases in the reaction of the organism on such hydrocarbons, primary decompensation, physiological adaptation, compensation of the pathological process, and the phase of pathological decompensation were observed. Lower olefins, such as ethylene, acetylene, and possibly propylene, may be regarded as harmless. Rather high toxicity of aliphatic hydrocarbons with up to 16 carbon atoms upon their direct entry into the lungs in the form of liquid or aerosol was determined. Tendencies toward leukopenia, increased erythrocyte sedimentation reaction, and reduced hemoglobin levels were observed after exposure to divinyl concentrations over 100 mg/cu m for 4 mo were observed in test animals. Exposure to isoprene concentrations of 200-600 mg/cu m for 6 mo caused catarrhal-desquamative bronchitis, focal emphysema, fatty degeneration of the liver, and giant-cell infiltrations in the kidney.

42191 **APTIC NO. 63637**

Teisinger, Jaroslav

BIOCHEMICAL RESPONSES TO PROVOACTIVE CHELATION BY EDETATE DISODIUM CALCIUM. *Arch. Environ. Health, vol. 23:280-283, Oct. 1971. 11 refs. (Presented at the Conference on Inorganic Lead, Amsterdam, Netherlands, Nov. 29, 1968.)*

The body burden of lead in 53 persons, whose occupational exposure to lead occurred mainly in foundries or storage battery manufacturing plants, was estimated, relatively, for the purposes of preventive medicine, by intravenously injecting 10 ml of a 20% solution of edetate disodium calcium (CaNa2 EDTA), after which the total output of the urine during the next 24 hr was collected and analyzed for lead content. The responses of the occupationally exposed persons up to the time of the injection were critical in terms of undue occupational risk when the urinary output of the lead during the next 24 hr amounted to as much as 2 mg. The amount of lead excreted in the urine did not vary with the blood lead content. All values in blood were above normal levels, however, the majority being above 0.08 mg/100 g. The excretion of 2 mg or more of lead during the 24 hr following injection of the chelating agent occurred, without exception, when the concentration of lead was 0.06 mg or more per 100 g of blood. The relationship of lead in urine and blood to coproporphyrin in the urine and the relationship of numbers of stippled erythrocytes to urinary lead excretion are also mentioned. (Author abstract modified)

42192 **APTIC NO. 63590**

Urbanowicz, Henryk

OCCUPATIONAL EXPOSURE TO INORGANIC COMPOUNDS OF LEAD. *Arch. Environ. Health, vol. 23:284-288, Oct. 1971. 12 refs. (Presented at the Conference on Inorganic Lead, Amsterdam, Netherlands, Nov. 29, 1968.)*

A group, initially of 60 persons, was subjected to mild occupational exposure to lead during a period of two years work in a new zinc and lead smelter. The men were under medical surveillance and the concentrations of lead in the air were determined at multiple sites on a bimonthly basis. Specimens of urine were provided at the end of 4 hr of work on a morning shift on a bimonthly basis. Urine was analyzed for content of lead, delta-aminolevulinic acid, and coproporphyrin. The data, while interesting, were not sufficiently revealing to provide suitable criteria for the appraisal of the severity of the exposure in relation to the danger of its continuance. (Author abstract)

42193 **APTIC NO. 63594**

Wynder, Ernest L. and Dietrich Hoffmann

CARCINOGENS IN THE AIR. *Texas Univ., Houston and Anderson (M. D.) Hospital and Tumor Inst., Houston, Tex., Environ. Cancer, Proc. Symp. Fundam. Cancer Res., Annu., 24th, 1971, p. 118-141, 1972. 45 refs.*

Many air pollutants may be carcinogens, including benz(a)anthracene, benzo(a)pyrene, dibenzo(a,h)pyrene, benzo(b)fluoranthene, benzo(j)fluoranthene, indeno(1,2,2-cd)pyrene, arsenic, asbestos, cadmium, chromate, isopropyl oil, mustard gas, beta-naphthylamine, nickel, and radioactive dust. These pollutants are emitted by tobacco smoke, automobile exhaust, and industries. The epidemiological and experimental evidence that the environment has a significant influence on the incidence of human cancer is reviewed. The effect is especially great in squamous types of cancer, and respiratory carcinogens play a significant role, particularly in respiratory tract cancer. Preventive work is of particular importance; the rise of lung cancer could be dramatically reversed if causative respiratory carcinogens were eliminated. Industrial respiratory carcinogens play a role in specific occuptional diseases but not in the overall incidence of cancer. Community air pollution does not appear to have a significant effect on cancer. The major respiratory carcinogens to man are in tobacco smoke. Success in reducing the popularity of the habit or in improving the cigarette itself would reduce the incidence of some of the major forms of cancer in modern society. (Author summary modified)

42194 **APTIC NO. 64024**

Zielhuis, R. L.

INTERRELATIONSHIP OF BIOCHEMICAL RESPONSES TO THE ABSORPTION OF INORGANIC LEAD. *Arch. Environ. Health, vol. 23:299-311, Oct. 1971. 96 refs. (Presented at the Conference on Inorganic Lead, Amsterdam, Netherlands, Nov. 29, 1968.)*

Increases in the rate of the absorption of lead by human beings, beyond that which occurs in consequence of the inevitable exposure in the common environment, result in biological responses represented by certain biochemical phenomena, without, necessarily, the development of any symptoms of lead poisoning. Articles in the scientific and professional literature dealing with the subject are examined. The relationships which exist between these biochemical responses to the absorption of lead are examined in order to demonstrate the extent to which each response can be employed as a prediction of the degree of lead absorption, as well as the status of the other phenomena. In this manner, the relative usefulness of these responses as indicators of the occupational hazard of lead absorption by exposed individuals and groups can be examined. The relationships between concentrations of lead in blood, of hemoglobin in blood, and of lead, delta-aminolevulinic acid, and coproporphyrin in urine to levels of lead exposure are discussed. Critical limits of biochemical responses to lead absorption as regarded by various investigators as evidence for differentiation of harmless and potentially dangerous occupational lead absorption are compiled, including concentrations of lead in whole blood, lead in urine, and delta-aminolevulinic acid in urine. (Author abstract modified)

1970

42195 **APTIC NO. 64094**

Hart, Roy H.

THE CONCEPT OF APS: AIR POLLUTION SYNDROME(S). *J. S. Carolina Med. Assoc., 66(3):71-73, March 1970. 5 refs.*

Case reports are described of persons having air pollution syndrome. A 37-year-old man in New York had back pains and chest pains which bore a relationship to background solution. He occasionally became nauseous and complained of a bad taste and foul odors. His symptoms varied in both nature and intensity as he traveled from city to city on business. He became asymptomatic on trips to the country and experienced the worst symptoms on days of heavy pollution in New York and Detroit. Physical examinations were essentially negative. When his pains were diagnosed as from a variety of causes, including hypochondriasis and neurosis, he went to a psychiatrist. Psychotherapy was brief and supportive. The patient acquired a home air conditioner and an electrostatic precipitator, and a good deal of symptomology cleared. He moved to a suburb where he was symptom-free. This was a case of air pollution syndrome-alpha. A 41-year-old-man in the Charleston area had air pollution syndrome-beta. He felt a tight, band-like constriction around his head constantly, experienced chest and neck pain, and had abdominal pain. The pain left when he left the Charleston area. He also had trouble concentrating and tasted a metallic taste. In the beta syndrome, abdominal discomfort is more noticeable, and chest, neck, and back pains are of a lesser degree than in alpha syndrome.

42196 **APTIC NO. 63628**

LaVerne, Albert

AIR POLLUTION, HEALING, AND CIVILIZATION. *Behavioral Neuropsychiat., 2(3-4):26-38, June-July 1970. 11 refs.*

A significantly lower number of acutely ill patients respond to conventional treatment methods when treated in normal polluted air than when treated in a pollution-free environment. A group of 300 patients was observed; 75% of the patients had acute neuropsychiatric disorders and 25% suffered from acute infectious diseases. Double blind controls were used in about 1/4 of the total, and an equal number served as controls themselves having failed to respond in the first part as experimental patients. A hypothesis and rational regarding air pollution versus healing are postulated. The effects of air pollution on medicine and therapeutic treatment should be studied further. The possible causal impact of air pollutants on society contributing to social turmoil is postulated. Decontamination of the polluted atmosphere may improve the health and functioning of leaders of nations and of people everywhere. (Author abstract modified)

42197 **APTIC NO. 63559**

LaVerne, Albert A.

NONSPECIFIC AIR POLLUTION SYNDROME (NAPS). PRELIMINARY REPORT. *Behav. Neuropsychiat., 2(7-8):19-21, Oct./Nov., 1970. 5 refs. (Presented at the International Symposium on Air Pollution vs. Healing, New York, Sept. 18, 1970.)*

The effect of breathing pure compressed air during sleeping hours was tested on 50 patients from the general urban population of New York City who were suffering from nonspecific air pollution syndrome, most frequently characterized by headache, fatigue, irritability, lassitude, insomnia, burning of the eyes, difficulty in concentration, impaired judgement, and depression. Mild clinical improvement was manifested in 35% (18) of the experimental group, while 30% (15) showed moderate clinical improvement and 7% (3) showed marked clinical improvement. The therapeutic effect was transient and noncumulative.

1969

42198 **APTIC NO. 61068**

Duric, D., V. Bojovic, L. Graovac-Leposavic, and S. Milic

STUDY OF ZINC EXCRETION IN THE URINE OF WORKERS RECEIVING CANA2 EDTA TREATMENT BECAUSE OF EXPOSURE TO LEAD. *(Izucavanje cinka u urinu prilikom primene CANA2 EDTA kod radnika eksponiranih olovu). Arch. Hig. Rada Toksikol., 20(4):687-691, 1969. 7 refs. Translated from Serbo-Croatian, 6p.*

Urinary lead and zinc elimination were determined simultaneously in 51 workers being treated with the calcium disodium salt of ethylene diamine tetraacetic acid for the purpose of lead mobilization. High urinary zinc excretion appeared in 43 of the subjects, regardless of the level of plumburia. A smaller number of patients (eight) showed low plumburia and lower zinc elimination simultaneously. The results indicate that the use of CaNa2 EDTA causes zinc depletion which must be taken into consideration in the treatment of lead poisoning with calcium. (Author conclusions modified)

42199 **APTIC NO. 65930**

Otto, H. and J. G. van Fragstein

OCCURRENCE OF ASBESTOS NEEDLES IN HUMAN LUNGS. *(Zur Haeufigkeit von Asbestnadeln in menschlichen Lungen). Text in German. Int. Arch. Gewerbepath. Gewerbehyg. (Heidelberg), vol. 25:193-201, 1969. 20 refs.*

Dust samples isolated from human lungs from individuals occupationally exposed and not exposed to dust were examined by phase contrast microscopy. In all lungs of 28 persons not occupationally exposed, needle-shaped particles up to 50 micron length were found. Among 190 occupationally exposed persons, most employed in the ceramics industry, 14 contained no needle-shaped particles at all in the lungs, or only particles below 10 micron in length. These dusts were collected from the lungs of persons with serious cases of silicosis, the nature and quantity of dust deposited in the lungs being determined by occupational exposure. In contrast to the single, although regular occurrence of needle-shaped particles in normal and silicotic lungs, the dust deposits in the lungs of persons exposed to asbestos contained many or abundant needle-shaped particles. However, a similarity with the asbestos bodies of histological sections became obvious only when these needles were longer than 20 micron. The difference in the proportion of needle-shaped particles in the lung dust collected from individuals exposed and not exposed to asbestos was of diagnostic value.

1964

42200 **APTIC NO. 63428**

Sargent, Frederick, II

THE IMPORTANCE OF THE STUDY OF HUMAN BIOMETEOROLOGY. *In: A Survey of Human Biometeorology. Frederick Sargent, II and Solco W. Tromp (eds.), World Meteorological Organization, Geneva (Switzerland), WMO - No. 160.TP. 78, Technical Note 65, p. 2-7, 104-113, 1964. 213 refs.*

Pollution of the atmospheric environment is discussed as an aspect of the function of human biometeorology. Biological variability is a natural characteristic of the system that relates organisms to environment including the atmosphere. Man's discovery of fire led to a modern technological era resulting in the discharge of gaseous and particulate wastes from industry and from the burning of fossil fuels. The pollutants have severely damaged animals and humans.

1962

42201 **APTIC NO. 63483**

Milly, George H.

COMMUNITY AIR POLLUTION AS A FACTOR IN LUNG CANCER AND OTHER DEGENERATIVE DISEASES. *Czechoslovak Academy of Sciences, Aerosols, Phys, Chem. Appl., Proc. Nat. Conf., 1st, Liblice, Czechoslovakia, 1962, p. 139-148. 31 refs. (Oct. 8-13.)*

A technique for investigating the relationship of chronic exposure to air pollution with various diseases is presented which involves increasingly more detailed climatological correction factors being applied to a series of air pollution emission indices chosen to reflect various classes of contaminants. The resulting sequences of progressively improved estimates of pollution dosage are correlated with disease mortality rates and the shift in correlation coefficients observed. A systematic increase in correlation between the corrected index and mortality rate would be expected where pollution is a contributing factor, and a corresponding positive value of the rank correlation between the coefficients and the correction factors would result. Application of the progression analysis has shown positive rank correlation for cancer of the respiratory tract and cancer of the buccal cavity of white females. A positive rank correlation was also observed for cancer the respiratory tract and for nonrheumatic endocarditis and myocardial degeneration on males when domestic fuel consumption was considered. No positive rank correlations were observed in any case for cancer of the stomach and esophagus or for arteriosclerotic heart disease.

42202 **APTIC NO. 63514**

Pickroth, G.

AEROSOLS IN MEDICINE AND BIOLOGY WITH SPECIAL REGARD TO ULTRASONIC AEROSOLS. *(Aerosole in Medizin und Biologie unter besonderer Beruecksichtigung der Ultraschall-Aerosole). Text in German. Czechoslovak Academy of Sciences, Aerosols. Phys. Chem. Appl., Proc. Nat. Conf., 1st, Liblice, Czechoslovakia, 1962, p. 829-841. 9 refs. (Oct. 8-13.)*

The advantages and uses of aerosols, and especially of ultrasonic aerosols, in medicine and in experimental biology are discussed. Of all methods of generating aerosols, ultrasonic aerosol generation is the best as it permits very small, respirable aerosol particles to be obtained. Up to 1 g active substance in 10 min in accurate doses can be applied. Ultrasonic aerosols can be used for the topical therapy of bronchopulmonal anomalies but they are also suitable for general therapeutic purposes due to their retention in the blood. Further, ultrasonic aerosols can be used for diagnostic purposes in human medicine, such as for thoracography, as well as for animal tests, e.g., for the study of the distribution of radioactive and other substances in the organism, and of the carcinogenic effects of certain substances. Compared to tests in which a given drug was injected or administered orally, inhalation provided higher and more persistent drug levels in the organism.

42203 **APTIC NO. 63515**

Pickroth, G.

ULTRASONIC AEROSOLS IN MEDICINE: STATISTICAL STUDIES INTO BLOOD PICTURE DETERMINATIONS FOLLOWING INHALATION AND ORAL APPLICATION OF ISONIAZID. *(Ultraschall-Aerosole in der Medizin: Statistische Untersuchungen zu Blutspiegelbestimmungen nach inhalativer und peroraler Application von INH). Text in German. Czechoslovak Academy of Sciences, Aerosols, Phys. Chem. Appl., Proc. Nat. Conf., 1st, Liblice, Czechoslovakia, 1962, p. 843-850. 6 refs. (Oct. 8-13.)*

The isoniazid concentrations in the blood were studied in patients after inhalation of 10 mg/kg concentration of isoniazid ultrasonic aerosol or after oral administration of this drug in a dose of 5 mg/kg. The blood tests extended over 6 hr after the end of the inhalation. The isoniazid concentrations in the blood were consistently and significantly higher after inhalation than they were after oral administration. Values of the isoniazid concentrations measured in the blood 1 hr after inhalation and oral administration were 5.7 micrograms/ml and 3.85 micrograms/ml, while the corresponding values determined after 4 hr were 2.69 micrograms/ml and 1.2 micrograms/ml. The isoniazid concentrations in the blood were highest between 0.5 and 1.5 hr after both inhalation and oral administration.

42204 **APTIC NO. 63516**

Spendlove, C.

UTILIZATION OF LUNG CLEARANCE RATES TO DETERMINE BACTERIAL AEROSOL PARTICLE DEPOSITION PATTERNS. *Czechoslovak Academy of Sciences, Aerosols, Phys. Chem. Appl., Proc. Nat. Conf., 1st, Liblice, Czechoslovakia, 1962, p. 851-858. 14 refs. (Oct. 8-13.)*

A method is presented which may be used to define deposition of microbial aerosols on ciliated and nonciliated surfaces below the larynx. A definition of the deposition pattern of infectious aerosol particles in the respiratory tract of the susceptible host is fundamental to an understanding of the mechanism of respiratory infection. Aerosol particles, small enough to pass through the nose but too large to be deposited in the regions of the alveoli, will be cleared rapidly in comparison with particles from smaller aerosols that are deposited in the alveolar spaces. What is needed is a definition of the two clearance curves, phagocytic and ciliamucus, as they form a total clearance curve of the respiratory tract below the oropharynx. A study could be undertaken to investigate the deposition patterns of bacterial aerosol particles in man utilizing the two-phase clearance curve to distinguish between deposition areas. Using quantitative data obtained by exposures to radioactive tracer organisms the amount of deposition of a given aerosol can be determined by projecting both slopes back to zero time.

42205 **APTIC NO. 63565**

Wagner, J. C.

EXPERIMENTAL PRODUCTION OF MESOTHELIAL TUMOURS OF THE PLEURA BY IMPLANTATION OF DUSTS IN LABORATORY ANIMALS. *Nature (London), 96(4850):180-181, Oct. 13, 1962. 5 refs.*

Various types of asbestos dust, a sample of 99.9% pure silica, and carbon black, the latter two being used as controls, were ground to a fine powder, suspended in normal saline, and injected into the pleural cavities of rats to study mesothelial tumor production. Pleural mesothelial tumors were observed in animals inoculated with crocidolite fibers, chrysotile fiber, and pure silica. Macroscopically and histologically, the tumors observed in the rats were similar to those seen in human cases. Additionally, hyaluronic acid secretion was demonstrated histochemically in four of the tumors, and in one case the secretion s presence was demonstrated in the pleural fluid.

1960

42206 **APTIC NO. 64057**

Wayne, L. G. and J. A. Orcutt

COMMON ORGANIC SOLVENTS AS PRECURSORS OF EYE-IRRITANTS IN URBAN ATMOSPHERES. *J. Occup. Med., no. 2:383-388, Aug. 1960. 9 refs.*

The degree of eye irritation produced on irradiating air containing various solvent vapors, each with nitrogen dioxide, was measured. Of the 12 solvents most used industrially in Los Angeles County, none showed appreciably greater potential for producing eye irritation than did the olefins, 2-hexene and 2-ethyl-1-butene, which were included in the series for purposes of comparison. At least 2/3 of the solvents tested showed eye irritation potential at least as great as that of n-hexane, which is one of the less active paraffinic constituents of gasolines. Those solvents less active than n-hexane were ethanol, isopropanol, acetone, and perchloroethylene. Among the various hydrocarbon-fraction solvents, the eye irritation potentials did not relate to boiling points. Presumably, such differences were determined by compositional differences between samples. Screening at 20 ppm and at 5 ppm gave essentially the same order of ranking for the solvents compared; the probability was less than 1% that the observed agreement could have arisen by chance. Thus, the order of decreasing potency of the solvents tested was nearly independent of concentration in these experiments. The assumption that the relative eye irritation potentials observed would also apply at atmospheric concentrations led to an estimate that the potential contribution of solvent vapors to eye irritation in the Los Angeles Basin may be about 1/10 of that due to automotive exhausts and gasoline vapors. (Author summary modified)

1939

42207 **APTIC NO. 65874**

Cristol, P., J. Fourcade, J. Ravoire, and C. Bezenech

ON CERTAIN CASES OF POISONING BY ARSENIC. *(A propos de quelqes cas d intoxications arsenicales). Text in French. Rev. Hyg. Med. Prev., 61(5):363-372, May 1939. 7 refs.*

Cases of acute and chronic poisoning by arsenic are reported. Diffuse pains, angor, edema of the limbs and genital, complicated by hepatic insufficiency and chronic bronchitis, were determined in a subject having lived near an industrial plant processing arseniferous ores for several years. The plant emitted several hundred kg finely dispersed arsenic oxide daily which settled on forage and vegetables. Symptoms of poisoning by arsenic were also detected in cattle in the same area. The installation of Cottrell type dust separators has helped to suppress the arsenic oxide emissions.

1937

42208 **APTIC NO. 65875**

Kiese, Manfred

CHRONIC POISONING BY ARSENIC HYDRIDE. *(Chronische Arsenwasserstoffvergiftung). Text in German. Naunyn- Schmiedebergs Arch. Pharmakol. Exp. Pathol., vol. 186:337-376, 1937. 72 refs.*

The action mechanism, resorption, metabolism, elimination, and physiological effects of arsenic hydride were studied in acute and chronic poisoning tests in dogs and rabbits exposed to this compound in the air. In rabbits exposed to 50-400 gamma l arsenic hydride for several hours, continuous resorption at rates of 20-30%, but no saturation, was observed. This finding is indicative of the rapid metabolism of arsenic hydride in the organism. In dogs exposed to 4 gamma arsenic hydride 7 hours daily for several weeks, reduction of the osmotic resistance of the erythrocytes, slight decrease in the hemoglobin and erythrocyte counts, and increased reticulocyte count were found. The serious anemia observed under the effect of 36 and 50 gamma arsenic hydride was due to the hemolytic action of this compound. The initially intense regeneration (strong proliferation of reticulocytes and leukocytes) ceased during the further course of the exposure leaving behind a stationary anemia which may suggest bone marrow lesion by arsenic hydride. Lesions of other organs were less pronounced. Ferruginous pigment was detected in the spleen liver, and bone marrow and slight edema of the hepatic and renal parenchyma cells was observed. The arsenic contents were highest in the spleen, liver, bone marrow, and erythrocytes and the arsenic concentration was always higher in the latter than in the serum. High arsenic concentration was found in hairs after prolonged exposure. Under conditions of uniform exposure, rather uniform elimination of arsenic from the organism was found.

EFFECTS-PLANTS AND LIVESTOCK

1974

42209 **APTIC NO. 63875**

Boertitz, Siegfried

THE IMPORTANCE OF INVISIBLE INFLUENCES OF INDUSTRIAL IMMISSIONS ON THE VEGETATION. *(Bedeutung unsichtbarer Einfluesse industrieller Immissionen auf die Vegetation). Text in German. Biol. Zentralbl., 93(3):341-349, 1974. 35 refs.*

The literature on the major invisible effects of industrial emissions on vegetation is reviewed. No macroscopically visible symptoms are produced in plants contaminated by gaseous and/or solid emissions if the pollutants are resorbed by the plant material and stored in the interior or adhere to the surface. Reactions in the plant material which occur only briefly due to concentration peaks in the emission area and are reversible produce neither visible signs nor structural changes within the cell. Long-term exposure to small emission concentrations might not produce any visible symptoms but can produce latent effects.

42210 **APTIC NO. 63544**

Brewer, R. F. and G. Ferry

EFFECTS OF AIR POLLUTION ON COTTON IN THE SAN JOAQUIN VALLEY. *Calif. Agr. 28(6):6-7, June 1974.*

Cotton grown in smog-free carbon filtered greenhouses stationed at various locations in California s San Joaquin Valley, noted for its photochemical air pollution, was compared with cotton at the same locations picked from the field. The difference in favor of filtered air was about 10% at five points on the west side of the valley. Vegetative growth was apparently not influenced by the presence or absence of the photochemical oxidants removed by the carbon filters, but senescence was delayed several weeks in the fall by the removal of existing pollutants.

42211 **APTIC NO. 65854**

Craker, L. E., J. L. Berube, and P. B. Fredrickson

COMMUNITY MONITORING OF AIR POLLUTION WITH PLANTS. *Atmos. Environ., 8(8):845-853, Aug. 1974. 17 refs.*

The use of tobacco plants as air pollution monitors for the demonstration of oxidant air pollution in Sudbury, Mass. is discussed. The monitoring sites were located on the property of homeowners who maintained the plants for the first 2 yrs of the study and additionally recorded plant injury during the 3rd yr. Relative oxidant levels at each monitoring site were determined by estimating the percentage of oxidant weather fleck injury to the tobacco plant leaves. An isopollutan map illustrated that there are decreasing levels of pollution from south to north for the southern half of the town and that there is a central corridor through the northern half of town at the 30% leaf injury levels. Pollution levels, as indicated by leaf injury, decreased east from the central corridor and decreased west from the central corridor. The northwest corner of the town had air pollution levels equal to the central corridor, as indicated by the leaf injury. The air pollution levels correlated visually with vehicular traffic patterns in the community.

42212 **APTIC NO. 63918**

Date, N., T. Sawada, T. Yoneyama, and S. Motohashi

OXIDANT DAMAGE OF TREES IN METROPOLITAN PARKS AND THE PHYSICOCHEMICAL PROPERTIES OF SOIL THEREIN. *(Tonai koen jumoku no okishidanto higai to dojo no rikagakuteki tokucho). Text in Japanese. In: Studies on Tokyo Smog. Tokyo Metropolitan Research Inst. for Environmental Protection (Japan), Rept. 3, p. 562-572, March 1974. 8 refs.*

A survey was made of plant vigor of trees and of soil cross section and chemical analysis. In comparison between parks, the average concentration of oxidant affected the plant vigor and the effect of soil condition was not clear. However, in comparison of individual trees within the parks there were cases in which the effect of soil condition was recognized. In Ueno Park where the paving is extensive and the trees do not have enough space for rooting, the nutritious substances represented by electric conductivity affected the vigor of zelkova trees. In other parks where the trees had enough space for rooting, soil condition did not affect the vigor of the trees, except in a park where the soil properties did not fit zelkova trees because of low and wet alluvial soil therein.

42213 **APTIC NO. 65776**

Evans, Lance S. and Irwin P. Ting

EFFECT OF OZONE ON 86 RB-LABELED POTASSIUM TRANSPORT IN LEAVES OF PHASEOLUS VULGARIS L. *Atmos. Environ, 8(8):855-861, Aug. 1974. 12 refs.*

The effect of ozone on 86-rubidium labeled potassium transport in the leaves of the bean, Phaseolus vulgaris was investigated. At low K concentration (below 0.2 mM) in the light, O3 decreased K uptake of bean leaf discs mimicking the effect of dark and dinitrophenol. At high K concentration (from 0.4 mM to 0.1 M) in the light, O3 caused a more marked uptake reduction than dark treatment. The reduced uptake did not parallel or mimic dark treatments at low K levels. Ozone possibly reduced the energy sources for uptake at low K concentration. At high K concentration a general K, and possibly a general cation leakage may be present. Low levels of O3 (0.5 ppm for 1 hr, which does not cause visible injury) result in reduced K uptake and accumulation in bean leaf discs. (Author abstract modified)

42214 **APTIC NO. 63917**

Fujita, N. and A. Kawamoto

ON THE GROWTH DISTURBANCE OF TREES IN TOKYO METROPOLITAN PUBLIC PARKS. *(Tokyo tonai toritsu koen nadono jumoku no seiiku shogai ni tsuite). Text in Japanese. In: Studies on Tokyo Smog. Tokyo Metropolitan Research Inst. for Environmental Protection (Japan), Rept. 3, p. 542-555, March 1974. 6 refs.*

The results of monthly surveys on the degree of growth disturbance of trees in several parts of Tokyo since 1971 are reported. The survey consisted of investigation early abnormal leaf-fall and discoloration of leaf presented in percentage according to the species and park. The period of survey was from May 1973 to April 1974, and the species of trees were zelkova, weeping willow, Carolina-poplar, Osmanthus fragrans var. aurantiacus and camphor. The growth disturbance of zelkova was more serious in the central parts of the metropolis than in the suburbs until 1971. In 1972, leaf-fall of zelkova did not appear and discoloration of leaf was slight until September. In 1973, the early leaf-fall was a little greater than in 1972, especially in July, however, the amount of leaf-fall was very small until autumn and discoloration of leaf was the same as in 1972. It was commonly recognized that Osmanthus fragrans var. aurantiacus did not flower in the metropolitan central areas, however, in 1972 about 70-80% of the trees flowered and in 1973 all the old trees flowered fully. Until 1970 chlorosis was seen in ginko leaves. Since 1971, however, the chlorosis has decreased, and in 1973 no necrosis was found until autumn. The recovery of plant vigor could not yet be related to climate and degree of air pollution.

42215 **APTIC NO. 66035**

Gruender, H. D.

DIFFERENTIAL DIAGNOSIS OF FLUORIDE POISONING IN CATTLE. *Fluoride, 7(3):135-142, July 1974. 29 refs. (Presented at the Conference of the I. S. F. R., 5th, April 8-11, 1973.)*

The effects of fluoride poisoning on cattle are discussed. Chronic fluoride poisoning in cattle is of great economic significance. It prevails in all parts of the world, mainly because of industrial emissions from metallurgic, ceramic, and chemical industries. Damage due to water high in fluoride or to fluoride present in phosphate rocks and other minerals involves only locally limited regions. The maximum threshold for chronic toxicity ranges 1.2 to 1.5 mg F/kg body weight which corresponds to 50-60 ppm in dry substance for readily soluble fluoride or for contaminated forage. Even lesser amounts in the range of 0.7 to 1.2 mg F/kg body weight can induce dental fluorosis without other toxic manifestations. The minimal acute toxic dose for readily soluble fluoride in cattle lies between 6 and 20 mg/kg body weight/day following oral uptake for several days. These values vary according to conditions of absorption.

42216 **APTIC NO. 64390**

Hampp, R. and H. Ziegler

ENRICHMENT OF LEAD IN STOMATA. *(Anreicherung von Blei in Scheliesszellen). Text in German. Naturwissenschaften (Berlin), 61(7):326-327, 1974. 1 ref.*

Leaves of spinach (spinacia oleracea L.) were placed with their stems immersed in a 5mM solution of lead nitrate at constant external conditions (22 C, 41% relative humidity, 2300 lux). The lead distribution in the epidermis cells and in the stomata was studied with an X-ray microprobe. A significant enrichment of lead in the stomata was observed. The lead accumulation in the epidermis cells was small but measurable.

42217 **APTIC NO. 63431**

Heath, Robert L., Phrosene Chimiklis, and Paula Frederick

THE ROLE OF POTASSIUM AND LIPIDS IN OZONE INJURY TO PLANT MEMBRANES. *In: Air Pollution Related to Plant Growth. American Chemical Society Symposium Series, Environmental Protection Agency Grant 801311, 29p., 1974 (?). 27 refs.*

The role of potassium and lipids in ozone injury to plant membranes was investigated. Changes in plants which are immediately noted can usually be related to loss of water from the leaf, as a necrosis or a dessication induced collapse of the palisade layers. Acute injury results in closure of the stomates which prevents O3 penetration and further water loss. Potassium plays a dominant role in maintaining a favorable plant cell water status and the deleterious effects of O3 occur primarily due to disruption of the normal ionic balance. The mechanism of O3 damage consists of O3 attach of a sulfyhydryl group or a fatty acid residue; permeability changes of the membrane leading to loss of K ion and loss of osmotic water; inhibition or loss of K ion pump activity for reacquisition of lost K ion, loss of a critical level of ion, and gross disruption of cellular metabolism.

42218 **APTIC NO. 63925**

Iijima, T., S. Sugata, and S. Motohashi

PHOTO-MICROSCOPIC OBSERVATION OF DAMAGED PLANTS BY PHOTOCHEMICAL OXIDANTS. *(Kokagaku okishidanto ni yoru higai shokubutsu no kogaku kenbikyo ni yoru kansatsu). Text in Japanese. In: Studies on Tokyo Smog. Tokyo Metropolitan Research Inst. for Environmental Protection (Japan), Rept. 3, p. 634-639, March 1974. 5 refs.*

The tissues of damaged parts of plants in fields seemingly affected by photochemical oxidants (29 species of 17 families), of plants exposed to 15-100 pphm of ozone for 3-90 hr (22 species of 16 families), and of plants exposed to 20 pphm for 9 hr (six species of five families) were examined microscopically. Symptoms such as bleached spots on spinach-leaves, which have appeared on 22 species of 13 families of plants in fields, were diagnosed as injury by ozone, and the appearance of symptoms and the characteristics of tissue change were reproduced by artificial exposure to ozone on 14 species of plants of 10 families to substantiate this finding. All of the tissues specifically damaged by ozone were palisade parenchyma, and the cellular damages were classified as deformation of cell walls and intercellular coloration, the former being mainly bleached spot and the latter being spots and necrotic spots. The symptoms such as necrotic spots on the lower surface of spinach leaves which have appeared on 4 species of plants of 3 families were diagnosed as injuries due to peroxyacetyl nitrate, and the appearance and specific changes of tissues were reproduced in Swiss chard and kidney bean by artificial PAN exposure. In the case of PAN injury, spongy parenchymatal cells were specifically damaged.

42219 **APTIC NO. 63930**

Iijima, T. and S. Motohashi

OXIDANT INDICATORY PROPERTIES OF SEVERAL AGRICULTURAL CROPS. *(Sushu nosakumotsu no okishi-danto shihyosei). Text in Japanese. In: Studies on Tokyo Smog. Tokyo Metropolitan Research Inst. for Environmental Protection (Japan), Rept. 3, p. 695-702, March 1974.*

Fifty three varieties of 25 species of agricultural crops belonging to 13 families were cultivated in a greenhouse with a filtered air section and ambient air section and in fields to investigate their oxidant indicator properties. Damages due to oxidant were observed on 20 species belonging to 12 families. The plants which were promising as ozone indicators were radish, kidney bean, lucerne, maize, and taro (Colocasia antiquorum). Swiss chard was promising as peroxyacetyl nitrate indicator. Intervarietal differences in oxidant susceptibility were conspicuous in kidney beans, maizes, and Swiss chards. The position of leaves most susceptible to ozone was 3rd or 4th from the top, and that to PAN was that of the upper leaves (a little younger and still growing). Damage to radish appeared after more than 4 hr of exposure to more than 8 pphm, after exposure to more than 10 pphm of oxidant, and after exposure for 3 hr at an oxidant dose of more than 30 pphm-hr. The damage consisted of bleached spots or white necrotic spots with a threshold value of 7 hr of 8 pphm oxidants with a maximum daily concentration of 15 pphm.

42220 **APTIC NO. 63945**

Iijima, T.

CROP INJURIES DUE TO PHOTOCHEMICAL SMOG. *(Kokagaku sumoggu ni yoru nosakumotsu no higai). Text in Japanese. Kongetsu no Noyaku (Agric. Chem. Mon.), 18(6):35-39, June 1974.*

Crop injuries due to photochemical smog are surveyed. The major constituents of photochemical smog, ozone and peroxyacetyl nitrate, and their major injuries on plants are described. Actual damage of major crops such as spinach, Chinese cabbage, kidney beans, soya, okra, maize, taro, welsh onion, crisp head lettuce, and peanuts by ozone and PAN are described. Species specificity in sensitivity to zone and PAN is discussed. Petunia is most sensitive, followed by kidney bean, lettuce, Swiss chard, tomato, Japanese radish, and spinach. Peanut and welsh onion are slightly resistant, and radish is most resistant to PAN. There is varietal specificity in some species of crops, e.g., kidney bean. Identification of oxidant injury is discussed.

42221 **APTIC NO. 63655**

Keller, T.

LEAD AS INDICATOR OF AIR FILTERING EFFECT OF WOOD PLANTS. *(Blei als Indikator der luftfilternden Wirkung von Holzgewaechsen). Text in German. Allgem. Forstztg., 29(25):588-589, 1974. 17 refs.*

A brief literature review of the dust filtering effect of trees is given. A 1-hectare beech forest has the capacity of binding as much as 68 tons of dust. Planting of hedges reduces the pollution of agricultural cultivations with lead compounds from automobile exhausts. To test the effect of hedges sphagnum moss, which has a large specific surface was exposed to exhaust gases at different distance from sources both in the open field and behind hedges. Due to the excellent filtering capacity of this moss an exposure time of only a few weeks leads to clear-cut results. The relative lead concentration of moss samples was measured as a function of the distance from the street. In an open and unprotected field the lead concentration of the samples declined with increasing distance from the street. A hedge, only 1 m high and 0.75 m thick, drastically reduces the lead concentration in the samples close to the street. For distances of more than 25 m the filtering effect of such a hedge is limited. High trees with a 6 m thick growth of bushes have the best filtering effect.

42222 **APTIC NO. 63916**

Komeiji, T., T. Sawada, I. Nouchi, and T. Odaira

SURVEY ON THE DECLINE OF URBAN TREES BY AIR POLLUTION. *(Taiki Osen ni yoru toshi jumoku no suitai ni kansuru chosa). In: Studies on Tokyo Smog. Tokyo Metropolitan Research Inst. for Environmental Protection (Japan), Rept. 3, p. 521-541, March 1974. 21 refs.*

A survey was made to determine the state of yearly decline of urban trees, to compare the local declines considering environmental conditions, to determine the locally characteristic phenomena, and to elucidate the relationship between the decline and environmental factors. The survey was carried out on 9 species (zelkova, ginko, cherry, pasania, white oak, red and black pine, Himalayan cedar, and platanus) in 19 public park gardens in Tokyo. The species which showed conspicuous decline as measured by densities of twigs and leaves were pasania, white oak, red pine, and black pine and the species which showed decline were Himalayan cedar, cherry, ginko and zelkova. Abnormal leaf-fall of zelkova was seen all over the metropolitan area without any differences between localities and period of leaf-fall, suggesting the influence of oxidant concentration. Necrosis of zelkova and ginko was frequently seen in the metropolitan center affected by primary pollutants such as sulfur oxides, dust-fall, and floating microdust. Necrosis of white oak was due to the compound effect of primary and secondary pollutants. As for the recovery from damage of pasania, the trees in 5 parks in the metropolitan center were over the recovery limit. Those in one park (Shakujii Park) were on the limit. Those in 3 parks did not reach the limit. The percentage age leaf-fall and physiological velocity of leaf-fall were closely correlated. The percentage of leaf-fall was high and the physiological velocity of leaf-fall was low in the locality where plant vigor was declining.

42223 **APTIC NO. 63687**

Leonard, A., Gh. Deknudt, and M. Debackere

CYTOGENETIC INVESTIGATIONS ON LEUCOCYTES OF CATTLE INTOXICATED WITH HEAVY METALS. *Toxicology (Netherlands), 2(3):269-273, Sept. 1974. 16 refs.*

The deaths of six cows near Hoboken, Belgium were attributed to lead contamination of hay which had been harvested near a plant refining metals. The diagnosis was supported by chemical analysis of the lead content of some organs and of one sample of hay. Further analysis performed on the soils showed that the field around the plant had increased metal content: lead was 20-60 times normal, chromium was + or - 8 times, cadmium + or - 50 times, cobalt was + or - 7 times, zinc was 50-400 times, and copper was 12 times. Arsenic in the grass was 50-200 times normal. Cytogenetic investigations were performed on the nine surviving cows. A few chromatid and chromosome breaks, one disturbance of spiralization, and one cell with three X-chromosomes were observed in the survivors. Generally, the chromatid and chromosome aberrations recorded were essentially of the same type as in control and exposed cows. (Author summary modified)

42224 **APTIC NO. 65918**

Martens, D. C. and C. O. Plank

BASIC SOIL BENEFITS FROM ASH UTILIZATION. *Bureau of Mines Information Circ., no. 8640:269-279, 1974. 17 refs. (Presented at the International Ash Utilization Symposium, 3rd, Pittsburgh, Pa., March 13-14, 1973.)*

Laboratory, greenhouse, and field investigation were conducted to identify beneficial effects of fly ash applications on plant growth and to determine levels of fly ash applications that allow normal plant growth. The greenhouse studies showed that application of selected samples of fly ash to soil increased the plant availability of soil boron, molybdenum, phosphorus, potassium, and zinc. Application of fly ash from the Big Sandy and Fort Martin plants increased yields of alfalfa grown in the field on Tatum silt loam. The yield increases were attributed to correction of boron deficiency. Application of fly ash from the Clinch River plant increased yield of alfalfa grown in the field on an acidic Cecil fine sandy loam. The yield increase was attributed to the increase in soil pH from fly ash application. The sample of fly ash under study neutralized 1.23 milliequivalents hydronium ion/g, which is relatively high compared with other samples of fly ash from bituminous coals. Two annual applications of 64 tons/acre of Glen Lyn fly ash did not adversely affect corn plants grown in the field on Davidson clay loam and Groseclose silt loam. The fly ash under study had weathered in a lagoon prior to use in the field experiments. Results of these studies indicated that relatively high amounts of weathered fly ash may be disposed of in agricultural soils. Two annual applications of 48 or 64 tons/acre of the weathered fly ash increased yield of corn grown in the field on Woodstown loamy fine sand. The specific reason for the yield increase was not identified. The fly ash may have increased yields by increasing the amount of available boron or calcium in the soil, by increasing the pH of the soil, or by increasing the content of moisture in the soil. (Author summary modified)

42225 **APTIC NO. 63924**

Matsushima, J., T. Odaira, and T. Sawada

CHANGE OF MICROSTRUCTURE OF LEAF CELLS BY PHOTOCHEMICAL REACTION PRODUCTS - ELECTRON MICROSCOPIC OBSERVATION OF ZELKOVA, POPLAR AND MORNING GLORY AFFECTED BY OZONE AND SULFUR DIOXIDE. *(Kokagaku hanno busshitsu ni yoru yo-saibo no bisai kozo no henka - ozon oyobi nisanka chisso ni yoru keyaki, popura oyobi asagao no denshi kenbikyoteki kansatsu). Text in Japanese. In: Studies on Tokyo Smog. Tokyo Metropolitan Research Inst. for Environmental Protection (Japan), Rept. 3, p. 626-633, March 1974. 3 refs.*

After exposing zelkova for 5 hr and poplar for 3 hr to 1 ppm ozone, and after exposing three varieties of morning glory (heavenly blue, scarlet O Hara and Hamano yosooi) to nitrogen dioxide at 20, 10, and 5 ppm, respectively, 30 min/hr and 4 hr/day for five days continuously, the microstructure of the exposed plant cells was observed electron microscopically. On acute injuries, conspicuous plasmolysis was observed on both species. While plasmolysis was more noticeable than cytoplasmatic change in zelkova, plasmolysis had progressed so far as to make cytoplasm of poplar completely contracted and destroyed. After exposing Hamano-yosooi variety of morning glory to 20 ppm of NO2 for 1 hr, disturbance of chloroplasts, especially their lamellar structure, was recognized without plasmolysis, but the mitchondrial change was not clear. After exposing heavenly-blue variety of morning glory to 20 ppm of NO2 for 30 min, although no damage was found by the naked eye, several degrees of damage were observed by electron microscopy. Chloroplastic lamella were curved, disturbed, cut, and completely destroyed without plasmolysis, but mitchondrial change was not clear. After exposing the same variety to 20 ppm of NO2 for 1 hr, the degree of injury was so great that the chloroplast was completely destroyed with no trace of chloroplastic lamella. After exposing Scarlet O Hara to 5 or 10 ppm of NO2 4 hr/day for 5 days, no great change was observed except for some chloroplastic lamella being clearly cut.

42226 **APTIC NO. 63941**

Matsushima, J.

EFFECTS OF PHOTOCHEMICAL SMOG ON PLANTS. *(Kokagaku sumoggu no shokubutsu ni taisuru eikyo). Text in Japanese. Kankyo Gijutsu (Environ. Conserv. Eng.), 3(7):513-518, July 1974.*

Photochemical smog damages plants through a synergistic relationship among ozone, peroxyacetyl nitrate, and nitrogen dioxides. Such plant damage was at first discovered in the outskirts of Los Angeles in 1944. Photochemical smog consists of ozone, the most abundant and the most phytotoxic; PAN, relatively less in amount but nearly toxic as ozone; and of NO2, the least toxic to plants. These three main components of photochemical smog cause necrosis, spot-like lesions, chlorosis by ozone, and injuries on the lower surface of leaves by PAN and NO2. The existence of species specificity of susceptibility of plants against various component of photochemical smog was also described.

42227 **APTIC NO. 63919**

Nouchi, I. and T. Odaira

INFLUENCE OF AIR POLLUTANTS ON PIGMENTS IN PLANT LEAVES. *(Taiki osen-shitsu no shokubutsu yo shikiso eno eikyo). Text in Japanese. In: Studies on Tokyo Smog. Tokyo Metropolitan Research Inst. for Environmental Protection (Japan), Rept. 3, p. 573-584, March 1974. 18 refs.*

Potted plants of morning glory, kidney beans, poplar, cherry, zelkova, and platanus were exposed to ozone and sulfur dioxide in an artificially weather-controlled room. After and/or before the exposure, chlorophyll, carotenoid, and anthocyan were extracted from the plant leaves, and the change of these plant pigments were studied. After exposure to 15 pphm ozone for 5-12 hr the total quantity of chlorophyll decreased and also the ratio of chlorophyll a/b decreased. Carotenoid in cherry leaves increased after ozone exposure, however, kidney bean and platanus leaves showed no change. Formation of anthocyan (recognized by its aglycone) in zelkova and morning glory leaves exposed to ozone was confirmed, the aglycone being identified as cyanidine and the sugar as glucose. After exposure to SO2 at 40-50 pphm for 18 hr (6 hr/day, 3 days), the chlorophyll and the ratio of chlorophyll a/b also decreased. Carotenoid was not affected by SO2. Ozone accelerates the senescence of plant leaves.

42228 **APTIC NO. 63920**

Nouchi, Isamu, Tadashi Sawada, Kuniko Kan, Takeshi Ohashi, Toshio Odaira, Tsutomu Iijima, Kazuya Terakado, Masateru Hikima, Motoki Iwanami, and Shigeo Sugata

RELATIVE RESISTIBILITY OF PLANT TO OZONE. *(Ozon ni taisuru shokubutsu no sotaiteki teikosei). Text in Japanese. In: Studies on Tokyo Smog. Tokyo Metropolitan Research Inst. for Environmental Protection (Japan), Rept. 3, p. 585-593, March, 1974. 10 refs.*

The results of experiments on the susceptibility and resistance of plants to ozone conducted between June 1972 and August 1973 are presented. Various species of trees, grass, vegetables, flowers, and beans were exposed to various concentrations of ozone from an ozone producer in an exposure chamber. The two basic concentrations were 15 pphm and 20 pphm. Different relative resistances of plants manifested themselves in terms of the time and concentration required for visible damages and in degrees of damage by the same concentration and exposure time. Large trees (woody plants) have higher resistance to ozone than annuals and other types of grass (herbaceous) plants. The most susceptible plants among the grass and vegetables were alfalfa, spinach, and small-leaf Chinese cabbage. Turnips and tomatoes had medium resistance and geranium and gladiolus had high resistance. Geranium did not show any damage from the 48 hr exposure to 15 pphm of ozone, but necrosis appeared in 6 hrs when exposed to 60 pphm of ozone.

42229 **APTIC NO. 63921**

Nouchi, I., T. Ohashi, T. Sawada, T. Odaira, M. Hikima, and M. Iwanami

EFFECTS OF COMBINED GAS COMPOSING OF OZONE AND SULFUR DIOXIDE ON TREES. *(Jumoku ni taisuru ozon to nisanka io no fukugo gasu no eikyo). Text in Japanese. In: Studies on Tokyo Smog. Tokyo Metropolitan Research Inst. for Environmental Protection (Japan), Rept. 3, p. 594-598, March 1974. 3 refs.*

Potted plants 2-3 yrs old were exposed respectively to 15 pphm of ozone, to 45 and 75 pphm of sulfur dioxide, and to a combined gas composed of 16 pphm of ozone and 18 pphm of SO2 in an artificially weather controlled room. The damage from ozone consisted mainly of small spots on the surface of grown leaves. The damage appeared most early on Caroline poplar (9 hr exposure), then on cherry, platanus, and Cersis (18 hr), and did not appear on Acer buergeriana, Querchus myrsinaefolia, Pinus thunbergii and Ginko biloba (60 hr). The symptoms of SO2 damage consisted of large necrotic spots between the veins and periphery of grown leaves and of reddish brown spots on grown leaves appearing 6-12 and 12-18 hr after exposure to 75 and 45 pphm, respectively. The damage appeared on all the trees except Acer buergeriana. After exposing trees to the combined gas for 4 days the damage appeared most early on Salix babylonica, then on Calorine poplar, followed by platanus, and by cherry (Prunus yedoensis). Damages appeared after 24 hr of 4 days exposure on Pinus thunbergii. The appearance of damage is accelerated by coexposure to ozone and SO2 and the enlarged damages thereby. It could not be determined whether the results were additive or multiplicative.

42230 **APTIC NO. 63922**

Nouchi, I. and T. Odaira

SYMPTOMS TO BE OBSERVED IN PLANTS DAMAGED BY PEROXYACETYL NITRATE. *(PAN no shokubutsu higai shojo). Text in Japanese. In: Studies on Tokyo Smog. Tokyo Metropolitan Research Inst. for Environmental Protection (Japan), Rept. 3, p. 599-606, March 1974. 15 refs.*

Peroxyacetyl nitrate was synthesized to conduct exposure tests to determine the symptoms of plants injured by PAN. Exposure rooms, equipped with two propel fans, consist of artificial meteorological twin rooms made of almite, glass, and stainless steel with an inner volume of 0.6 cu m. The concentration of PAN was measured at intervals of 20 min. Temperature was 30 C with humidity 45 or 90%. Decreases in PAN concentration were not affected by humidity and PAN remained stable for 3 hr in the chamber. A decrease in PAN concentration was measured by employing petunia, zelkova, morning glory, and haricot bean planted in pots. The decrease in PAN concentration was linear, reaching half of the original value in 30 min. Damages by PAN were not observed (with the exception of haricot bean and tomato) during the exposure test, but in many cases they appeared on the following day. The extent of damages depends upon the type of plants, concentration of PAN, the growth stage, and the environmental conditions. Glazing appeared in reverse leaves of plants, followed by bronzing. Silvering was not as marked. In the case of Swiss chard, damages were limited to young leaves in which small black-brownish flecks appeared in the upper surface. Damages to tomato were also limited to young leaves. Black necrosis flecks appeared between veins adjacent to the range of leaves in the upper surface, while the lower surface showed blackish bronzing.

42231 **APTIC NO. 63928**

Odaira, T., T. Sawada, T. Komeiji, I. Nouchi, T. Ohashi, N. Date, T. Iijima, and K. Terakado

INVESTIGATION OF INFLUENCE OF PHOTOCHEMICAL SMOG BY DAMAGE ON MORNING GLORY. *(Asagao ni yoru kokagaku sumoggu eikyo chosa). Text in Japanese. In: Studies on Tokyo Smog. Tokyo Metropolitan Research Inst. for Environmental Protection (Japan), Rept. 3, p. 655-672, March 1974. 6 refs.*

Smog damage to two varieties of morning glory was investigated in Tokyo and contrasted to that in control locations. The damage appeared when the oxidant daily dose reached 60 pphm-hr, and the oxidant concentration reached 15 pphm. The first day of damage occurrence was July 2-11 with local differences. In 3 cases when high concentration of oxidant occurred over wide localities, the damage to morning glory appeared at more than 90% of the schools where morning glory had been planted. No relation was recognized between photochemical smog and decolorization spots on the leaves of the plant; however, such spots appeared at 63% of monitoring schools. The accumulated damage within two weeks from July 1 on the Scarlet O Hara variety was more than 50% at almost all the monitoring schools. The position of damaged leaves was the 6th to 11th leaves. Local difference was observed in the percentage of damaged leaves. On the plants in a control school in Shirakawa (Fukushima Pref.) some slight damage was observed. From these findings, no pin-point phenomenon of photochemical smog was observed, and the plant damage due to existing photochemical smog of the Tokyo area presumably covered a broad area with a diameter of about 100 Km centering around metropolitan Tokyo.

42232 **APTIC NO. 63671**

Oshima, R. J.

A VIABLE SYSTEM OF BIOLOGICAL INDICATORS FOR MONITORING AIR POLLUTANTS. *J. Air Pollution Control Assoc., 24(6):576-578, June 1974. 12 refs. (Presented at the International Congress of Plant Pathology, 2nd, Minneapolis, Minn., Sept. 1973, Paper 0996.)*

An air pollution monitoring biological indicator (AMBI) system for ambient ozone was tested in the South Coast Air Basin of California during the 1972 fall growing season. The basic unit or AMBI station was an inexpensive, portable plant station which operated independently of power sources. Reliability of the unit was excellent, as only three instances of missing data were observed from 330 possibilities. The unit consisted of six indicator plants (pinto beans) with enough water for sustaining the plants in the field for 7 days. A photo-reference system of O3 injury evaluation utilizing direct comparisons of injured leaves with reference photographs was successful in standardizing assessments of O3 injury. Average weekly injury indices for field locations were correlated with average weekly O3 dosages and were significant at the 0.01 level. (Author abstract modified)

42233 **APTIC NO. 63926**

Sawada, T., T. Ohashi, I. Nouchi, and T. Odaira

ON MORNING GLORY AS AN OXIDANT INDICATOR (A). *(Asagao no okishidanto shihyo-sei ni tsuite-A). Text in Japanese. In: Studies on Tokyo Smog. Tokyo Metropolitan Research Inst. for Environmental Protection (Japan), Rept. 3, p. 640-645, March 1974.*

Seedlings of Scarlet O Hara variety of morning glory having four leaves were transplanted in a residential area about 20 Km west of the center of Tokyo, and the existence of damage, the total number of leaves, the number of damaged leaves, the position of damaged leaves, and the degree of damage were observed daily at 8-9 am from June to September 1973. Specific symptoms of oxidant damage to the leaves of morning glory were dependent on the degree of exposure to oxidant: chlorosis with relatively light exposure, bleached spots with moderate exposure, and necrosis with higher exposure of grown leaves to ozone as well as silvering of the lower surface probably due to exposure to peroxyacetyl nitrate. Although chlorosis, bleached spots, and necrosis were recognized on leaves artificially exposed to ozone, the silvering is not yet identified experimentally as due to PAN. There are cases when only bleached spots appear or when both bleached spots and necrotic spots appear simultaneously after one exposure. The damage due to oxidant was more serious on lower leaves. Symptoms such as bleached spots and necrotic spots appeared in all of the following environmental conditions: oxidant concentration more than 15 pphm, continuous exposure for 2 hr to oxidant concentrations more than 15 pphm, and daily dose (9 am-6 pm) of oxidant at more than 80 pphm-hr.

42234 **APTIC NO. 63927**

Sawada, T., T. Ohashi, I. Nouchi, and T. Odaira

ON MORNING GLORY AS AN OXIDANT INDICATOR (B). *(Asagao no okishidanto shihyo-sei ni tsuite-B). Text in Japanese. In: Studies on Tokyo Smog. Tokyo Metropolitan Research Inst. for Environmental Protection (Japan), Rept. 3, p. 645-654, March 1974. 5 refs.*

Seventy-four varieties of about 150 strains of morning glory were transplanted to a garden in the campus of Ibaragi Univ. (45 km NE of Tokyo), and the growth states, symptoms (kind and degree), and the amount of damage due to oxidant were observed as well as the status of oxidant at the nearest monitoring point. After investigating the suitability of varieties as oxidant indicators, the 30 varieties were screened and classified as to susceptibility to oxidant. The varieties of 11 strains were relatively susceptible to oxidant. Eight varieties of 10 strains were lower in susceptibility. On 8 varieties of 10 strains a specific chlorosis appeared. Anthocyan appeared conspicuously on plants with purple stems, but not on plants with green stems. Damage had previously appeared on the Scarlet O Hara variety when oxidant dose was over 60-80 pphm-hr, however, in the present investigation no damage appeared on Scarlet O Hara in spite of at least 5 days with oxidant dose higher than 60 pphm-hr and at least 2 days at more than 80 pphm-hr. This is apparently due to differences between strains of Scarlet O Hara.

42235 **APTIC NO. 63929**

Sawada, T., T. Komeiji, I. Nouchi, T. Ohashi, T. Odaira, N. Date, T. Iijima, K. Terakado, M. Iwanami, T. Yoneyama, and H. Fukuda

ON THE RESULT OF WIDE-AREA INVESTIGATION OF PLANT DAMAGE IN TOKYO AND THE THREE NEIGHBORING PREFECTURES. *(Itto sanken shokubutsu higai koiki chosa kekka ni tsuite). Text in Japanese. In: Studies on Tokyo Smog. Tokyo Metropolitan Research Inst. for Environmental Protection (Japan), Rept. 3, p. 673-694, March 1974. 7 refs.*

The status of plant damage due to environmental pollution by oxidant was investigated. The plants utilized as pollution indicators were spinach (New-asia variety), radish, and two varieties of morning glory, Scarlet O Hara and Violet, all potted and buried in the soil of monitoring points (17 points near air pollution monitoring stations) distributed in Tokyo. Maize, taro, and 5 other species were utilized as indicators. The days of damage-investigation were June 23 (2 days after a highly polluted day) and July 30 (4 days after a highly polluted day). After the high oxidant concentration of June 21, the damage to spinach was high in the center of the city and was lower in suburbs, and did not appear west of Tachikawa. The damage symptoms were intervenal spots of necrosis and chlorosis with irregular form with some silvering and oily immersion points severely damaged by oxidant. No damage was observed on morning glory on June 23, probably due to the plant stage in which susceptibility to oxidant did not develop. The damage to spinach appeared in the area where oxidant dose was more than 50 pphm-hr with some exceptions. No remarkable damage was observed on July 30. Some consideration was given to the relationship of damage to morning glory with the oxidant monthly dose. Average percentage of damaged area of leaves better represents the cumulative damage than does the percentage of damaged leaves. On the average, Scarlet O Hara was more susceptible to oxidant than the Violet variety.

42236 **APTIC NO. 63872**

Steubing, Lore, Rainer Klee, and Ulrich Kirschbaum

EVALUATION OF AIR HYGIENIC CONDITIONS IN THE LOWER MAIN REGION BY MEANS OF LOWER AND HIGHER PLANTS. *(Beurteilung der lufthygienischen Bedingungen in der Region Untermain mittels niederer und hoeherer Pflanzen). Text in German. Staub, Reinhaltung Luft, 34(6):206-209, June 1974. 25 refs.*

Mapping of the natural growth of epiphytic lichens and evaluation of the injuries of explants of Hypogymnia physodes yielded three lichen zones in the Lower Main Region which corresponded to the extent of atmospheric pollution. Zone I covers the three most polluted areas of the Lower Main Region, Frankfurt, Hanau and Eddersheim-Ruesselsheim. Typical is the oval expansion in northeastern direction, which can be explained by the prevailing winds from southwest. The visible injuries of the explants are functionally correlated to the chlorophyll destruction. The sulfur concentration, conductivity and osmotic value of spruce needles of spruces exposed in the center of Frankfurt and in the suburbs was determined. The results of these tests revealed the heavy sulfur dioxide pollution of the center of Frankfurt. In addition, the dust fall was measured with Bergerhoff units which were set up in the two zones entirely unobstructed and in the midst of rhododendrons. The spring (May) measurements in the city center yielded a dust concentration of 310 mg/100 sq cm in 30 days for the unobstructed Bergerhoff units and 612 mg/100 sq cm/30 days for the rhododendron surrounded units. In the suburbs, the determined values were 48 mg for the unobstructed units and 37 mg for the rhododendron-surrounded units. In November, dust concentrations of 695 mg (unobstructed) and 1006 mg (rhododendron surrounded) for the city center and 108 mg as well as 111 mg/100 sq cm 30 days for the suburb were measured.

42237 **APTIC NO. 63923**

Toyama, S., T. Odaira, and T. Sawada

EFFECTS OF OZONE ON THE CHLOROPLASTS IN LEAVES OF MORNING GLORY. *(Asagao no kururupurasuto ni oyobosu ozon no eikyo). Text in Japanese. In: Studies on Tokyo Smog. Tokyo Metropolitan Research Inst. for Environmental Protection (Japan), Rept. 3, p. 607-625, March 1974. 32 refs.*

Morning glories (1 m height) were placed in twin artificial meteorological rooms. Clean air was fed to one room, while ozone was fed to the other. Exposure times on the initial day was 1, 2 and 4 hr and 1, 2, and 4 hr on the following day. Thus the 5th and 11th leaves, exposed to ozone for a total of 2, 4 and 8 hr, were employed as a experimental material. Among the leaves exposed to ozone for 8 hr, slight necrosis appeared in the fifth leaf and small decolorized flecks in the 11th. The most outstanding changes were observed on the chloroplasts in leaves of morning glory after exposure to 0.15 ppm ozone. Lamellar structure on the chloroplasts were destroyed in proportion to exposure time. The fifth leaf, for example, disintegrated after 8 hr exposure, thereby showing remarkable decrease in volume of chlorophyll. The number of chloroplast globules increased rapidly with increasing disintegration of lamellar structure. After 8 hr exposure plastids in the fifth leaf were almost filled with globules. Particles of phytoferritin were produced on stroma in plastids of the fifth leaf after 2 hr exposure to ozone. They showed a crystal structure of lattice configuration. Lysosomes, which fill stroma on the chloroplasts, showed remarkable decrease with increase in length of exposure to ozone.

42238 **APTIC NO. 63657**

Woidich, Herbert and Werner Pfannhauser

CONTRIBUTION TO THE ANALYSIS OF CADMIUM IN FOODS. *(Zur Analyse von Cadmium in Lebensmitteln). Text in German. Z. Lebensm. Unters. Forsch. (Munich), 155(2):72-76, 1974. 33 refs.*

The increasing use of cadmium in electrolytic metal coating, for the manufacture of batteries, and for coloring lead to a growing emission of cadmium in the biosphere and thus also to a growing concentration in food. Trace cadmium in food such as grains, mussels, and fish is determined by the photometric method using dithizone and atom absorption spectrometry. Optimum procedural steps are discussed. For preparation of the samples wet ashing proved to be more suitable than dry ashing. Of the examined grains oats measured the highest concentration ranging from 1.1 to 1.93 ppm. The Cd concentration in mussels of 0.05 to 1.74 ppm confirmed earlier results reported in the literature which show that mussels tend to store the CD from all the surrounding neighborhood. Cadmium analyses of pork yielded an average concentration of 0.014 ppm Cd, of pork kidneys 0.15 ppm Cd.

42239 **APTIC NO. 63931**

Yoneyama, T., S. Kurihara, N. Date, and S. Motohashi

OXIDANT INDICATORY PROPERTIES OF SOFT AND WEAK VEGETABLES. *(Nanjaku yasai no okishidanto shihyosei). Text in Japanese. In: Studies on Tokyo Smog. Tokyo Metropolitan Research Inst. for Environmental Protection (Japan), Rept. 3, p. 703-708, March 1974. 3 refs.*

Soft and weak vegetables were grown in 1972 and 1973 in fields of the Edogawa branch of the Tokyo Metropolitan Agricultural Experiment Station to observe the damage due to oxidant. The vegetable species were spinach, two kinds of salting green, Swiss chard, crisp head lettuce, welsh onion, kidney bean, young soy bean, and maize. The vegetables could be classified into 3 categories, the most susceptible to oxidant such as spinach and a salting green (Bekana), the moderately susceptible such as Swiss chard, crisp head lettuce, welsh onion, salting green (Komatsuna), young soy bean, and maize, and the least susceptible kidney bean. The injuries were observed at oxidant doses over 5 pphm, at less than 40 pphm-hr, less than 80 pphm-hr, and less than 120 pphm-hr respectively. The extent of damage to the vegetables exposed to the same concentration of oxidant were in the descending order spinach, Bekana, Swiss chard, and Komatsuna. A damage classification system is proposed.

42240 **APTIC NO. 63932**

Yoneyama, T., T. Ohashi, T. Sawada, N. Date, and S. Motohashi

EFFECTS OF PH OF THE SOIL ON OXIDANT DAMGE OF PLANTS. *(Shokubutsu no okishidanto higai ni oyobosu dojo pH no eikyo). Text in Japanese. In: Studies* *on Tokyo Smog. Tokyo Metropolitan Research Inst. for Environmental Protection (Japan), Rept. 3, p. 709-724, March 1974. 1 ref.*

In order to elucidate the relation between soil pH and plant damage, morning glory (Scarlet O Hara), spinach, and radish were potted in soils with controlled pH in open air and in a controlled greenhouse with artificial illumination under 0.15 or 0.25 ppm ozone. Damage to morning glory included chlorosis, bleached spots, and necrosis of the leaves. Spinach and radish were dehydrated with bleached spots and necrosis of leaves. The damage to morning glory (Scarlet O Hara) potted in alluvial soil was least when the pH of the soil was kept near 6.7, and damages to spinach and radish potted in several kinds of soil were least when the pH of the soil was kept, respectively, at 6.1-6.2 and 5.5-6.5. These values of soil pH coincided with those at which each plant is most preferably grown.

42241 **APTIC NO. 63865**

Saitama Prefectural Government (Japan), Bureau of Education, Horticultural Experiment Station, and Pollution Control Center

AN INVESTIGATION OF AIR POLLUTION BY A PLANT SURVEY, 1973. *(Shokubutsu ni yoru taiki osen chosa hokokusho). Text in Japanese. 16p., 1974.*

Morning glories, coxcombs, and scallions were used as indicators to see the relationship between oxidant level and plant damages in Saitama prefecture. Thirty-two elementary and junior high schools were selected, one per 25 sq km, as locations of testing, and eight locations with oxidant monitoring stations were selected as control areas. Morning glory species were heavenly blue (HB) and purple lions, coxcombs were scarlet giant (SG), and kincho (K). On May 13 when oxidant level was high (cumulative level 90 pphm), HB were seriously damaged in three locations, lightly damaged in three other locations, and SG were lightly damaged at 10 locations. The K was damaged heavily at three locations. The minimum level for clear visually damages was 90 pphm (hourly average 10 pphm). The damages on HB leaves were white mottles between veins. On SG, shapeless yellow-white spots appeared between veins. On the day of high oxidant in August (250 pphm cumulative; 6.9 pphm hourly), damages were much more serious, and chlorosis and necrosis appeared. Morning glories were the most appropriate and sensitive indicator, and coxcombs and scallions were less sensitive. The last two were not suitable also because the leaf regeneration was slow and it was difficult to judge the oxidant damages when the concentration was high over a period of time. The HB was a good indicator, but rather quickly deteriorated and it was difficult to care for. There was a correlation between oxidant concentration and plant damages, but areas with high oxidant concentrations were not necessarily damaged. Micrometeorology and the growth condition of indicators also seemed to affect damages. In early August, damages occurred not only in polluted areas but in control areas also, and further investigation is required.

1973

42242 **APTIC NO. 64207**

Anderson, Wilbur C. and O. C. Taylor

OZONE INDUCED CARBON DIOXIDE EVOLUTION IN TOBACCO CALLUS CULTURES. *Physiol. Plantarum., vol. 28:419-423, 1973. 38 refs.*

Callus derived from Bel-W3 and Bel-B tobacco plants when exposed to ozone turned brown as a consequence of sulface cell destruction. Ozone fumigations above a threshold concentration of 0.10 microliters/l for 2 hr caused an increase in the rate of tissue carbon dioxide evolution. The maximum increase in CO2 evolution was about 65% for both the ozone-sensitive Bel-W3 and resistant Bel-B callus. However, the ozone dosage required to attain maximum increase in CO2 evolution was approximately two times greater for the resistant variety. Callus cultures that grew roots were more resistant to ozone. The addition of the antioxidant N,N prime diphenyl-p-phenylenediamine (DPPD) to the nutrient medium retarded ozone-induced CO2 evolution. (Author abstract)

42243 **APTIC NO. 65946**

Bradshaw, A. D.

THE ECOLOGICAL EFFECTS OF POLLUTANTS. *Inst. of Fuel, London (England), Fuel Environ. Proc. Conf., Eastbourne, England, 1973, p. 129-134. 35 refs. (Nov. 26-29, Paper 10.)*

The ecological effects of coal mining on the land and airborne sulfur dioxide emission on vegetation are considered in connection with the British fuel industry. Sulfur dioxide emissions are a problem in terms of short range transport of SO2 and long range transport sulfates resulting from the oxidation of SO2. Major plant damage occurs when SO2 concentrations reach about 400 micrograms/cu m, though there is increasing evidence that low levels of SO2 can cause reductions in growth without visual symptoms. Sulfate deposition usually occurs either as a sulfuric acid or as ammonium sulfate, with either form adding to the acidity of soil and causing in high enough concentrations the leaching of calcium from the soil.

42244 **APTIC NO. 63554**

Cameron, J. W. and O. C. Taylor

INJURY TO SWEET CORN INBREDS AND HYBRIDS BY AIR POLLUTANTS IN THE FIELD AND BY OZONE TREATMENTS IN THE GREENHOUSE. *J. Environ. Quality, 2(3):387-389, 1973. 10 refs.*

Five inbreds of corn (Zea mays L.) and three of their Fl hybrids were grown in the field under natural summer air pollution conditions in 1971. During the following fall, four of the inbred and two hybrids were grown in greenhouses and received controlled ozone treatments. The cultivars showed highly significant differences in injury under field conditions, but much smaller differences in the greenhouse tests. In the field, four inbreds were relatively resistant; the fifth was highly susceptible. The three hybrids showed some correlation with the resistance of their parents. In the greenhouse, with repeated dosages of O3, all tested inbreds showed substantial damage when 4 to 7 weeks old, but at flowering, the field-susceptible inbred was the most severely damaged. The hybrids also showed severe damage as young plants, while at flowing, their damage from greenhouse treatments was related to their field susceptibility. Injury symptoms in the field were typical of O3 injury in the greenhouse. In all cultivars, yound leaves were less injured than fully mature leaves. (Author abstract)

42245 **APTIC NO. 63562**

Carney, A. W., G. R. Stephenson, D. P. Ormrod, and G. C. Ashton

OZONE-HERBICIDE INTERACTIONS IN CROP PLANTS. *Weed Sci., 21(6):508-511, Nov. 1973. 26 refs.*

Tomato, white bean, and tobacco plants were pretreated with various herbicides prior to fumigation with ozone concentrations between 0 and 30 pphm for two 1.5 hr periods to test for synergistic or antagonistic interactions. The natural logarithms of the dry weight data were subjected to multiple regression analysis. Synergistic phytotoxicity was definitely observed for the herbicide pebulate and possibly for chloramben in combination with ozone on tobacco; while for most of the other combinations the phytotoxicity in the presence of ozone was additive, with no interaction being indicated. An antagonistic interaction between ozone and benefin was indicated on the tobacco cultivars. (Author abstract modified)

42246 **APTIC NO. 63566**

Johnsen, Ib and Ulrik Sochting

INFLUENCE OF AIR POLLUTION ON THE EPIPHYTIC LICHEN VEGETATION AND BARK PROPERTIES OF DECIDUOUS TREES IN THE COPENHAGEN AREA. *Oikos, 24(3):344-351, 1973. 26 refs.*

Sulfur dioxide measurement, bark analysis, and vegetation mapping were performed to investigate the influence of air pollution on epiphytic lichen vegetation of trees in the Copenhagen area. Isopleths of SO2 coincided well with the inner distribution limits of the lichens, indicating specific critical SO2 levels for the different species. Several species can be useful biological indicators of SO2 pollution. Bark properties changed as follows on approaching the city center: average pH decreased from 5.0-3.0, and average sulfur content in percent dry weight increased from 0.25% to 0.45%.

42247 APTIC NO. 63725

Kodama, Takenori, Haruhisa Ogita, and Kiyokazu Mizoguchi

LEAD POLLUTION BY AUTO EXHAUST GAS. *(Jidosha haiki gasu ni yoru namari osen). Text in Japanese. Aichiken Kogai Chosa Senta Shoho (Rept. Environ. Pollut. Res. Cent., Aichi Pref.), no. 1:28- 33, March 1973. 3 refs.*

To investigate the relation between traffic quantity and auto exhaust, as well as the horizontal diffusion of lead compounds around the earth, lead contents of soils gathered from various spots in Nagoya were determined by X-ray fluorescence analysis. The average lead value of 50 samples at a crossroads was 215 ppm, and the variation ratio among them was 32%. Samples from parks gave 33 ppm lead, or 115 the content of the crossroad. Lead pollution by auto exhaust gas was proved and the lead content in the earth increased proportionally to the traffic quantity. Soils which had not been polluted contained about 10 ppm lead and crossroad soils contained as much as 20 times that. Horizontal lead diffusion is prevented by trees, and without them dispersion can spread for 200 m. Green belts with abundant trees are effective control measures for auto exhaust gas emissions.

42248 APTIC NO. 65934

Lees, D. R., E. R. Creed, and J. G. Duckett

ATMOSPHERIC POLLUTION AND INDUSTRIAL MELANISM. *Heredity, 30(2):227-232, 1973. 21 refs.*

The distribution of melanic forms in two moth and two ladybird (ladybug) species was analyzed in relation to fourteen environmental variables by multiple regression analysis. Local smoke levels were important factors in Phigalia pedaria and Adalia bipunctata, whereas in Biston betularia, sulfur dioxide was more important. The importance of crypsis was indicated in P. pedaria, but not in the warningly colored A. bipunctata; nor was it confirmed in B. betularia, despite earlier experimental results. There was no evidence for industrial melanism in Adalia decempunctata. (Author abstract)

42249 APTIC NO. 63557

Manning, W. J., W. A. Feder, and P. M. Vardaro

REDUCTION OF CHRONIC OZONE INJURY ON POINSETTIA BY BENOMYL. *Can. J. Plent Sci. (Ottawa), vol. 53:833-835, Oct. 1973. 15 refs.*

Poinsettia plants (Euphorbia pulcherrima Wild.) were repeatedly exposed to ozone at 0.10 microliter/l (10 pphm) for 8 hr/day, 5 days/wk, for 68 days and compared with plants grown in ozone-free charcoal-filtered air. The fungicide Benomyl (methyl-1- (butylcarbamoyl)-2-benzimadazole carbamate) was then applied as a soil drench to plants in both air regimes at 0, 500, and 1000 micrograms/ml at 3, 30 and 57 days after initiation of the experiment. Untreated plants of both cultivars exposed to O3 developed symptoms of chronic O3 injury expressed as chlorosis and senescence of lower leaves, decreases in stem diameter, and fresh and dry weights of stems and leaves. Benomyl soil drenches, at both rates, significantly reduced incidence of chronic O3 injury on both cultivars. (Author abstract modified)

42250 APTIC NO. 63627

Mudd, J. B.

BIOCHEMICAL EFFECTS OF SOME AIR POLLUTANTS ON PLANTS. *Advan. Chem. Ser., no. 122:31-47, 1973. 82 refs.*

The properties of the air pollutants sulfur dioxide, nitrogen oxides, peroxyacyl nitrates, and ozone are considered from chemical, biochemical, and physiological points of view. Physiological observations cannot demonstrate the chemical mode of toxicity. Chemical and in vitro biochemical studies may be irrelevant at the physiological level. Consideration of all three approaches indicates which hypotheses of toxicity are more plausible and suggests new areas of investigation. (Author abstract)

42251 APTIC NO. 63717

Numata, M.

ECOLOGICAL APPROACH TO ENVIRONMENT PRESERVATION ESPECIALLY ON THE BIOLOGICAL INDICATORS. *(Kankyo hozen eno seitai gakuteki sekkin - tokuni seibutsu shihyo ni tsuite). Text in Japanese. Chiba Daigaku Kankyo Kagako Hokoku (Rep. Environ. Res. Organ., Chiba Univ.), 1(2):231-236, Dec. 1973. 30 refs.*

General concepts of biological and plant indicators are discussed. Plant species which are very susceptible to environmental pollution and plant species which are relatively resistant to air pollution yet are affected by the pollution are discussed as pollution indicators. The change of ecosystem is an indicator of urbanization and air pollution. Some indicator plants would be useful as pollution-removing agents.

42252 APTIC NO. 63553

Swanson, Elizabeth S., William W. Thomson, and J. Brian Mudd

THE EFFECT OF OZONE ON LEAF CELL MEMBRANES. *Can. J. Botany, 51(6):1213-1219, 1973. 33 refs.*

The effects of ozone on membrane lipids and on the electron-density patterns of cell membranes in electron micrographs were determined in a study of the highly ozone-susceptible Bel W-3 variety of tobacco. Some plants were exposed to 0.3 + or - 0.03 ppm ozone for 2 hr between 10 and 12 am, while some plants were kept as controls. Immediately after the fumigation and 2 hr later, samples from treated and control plants were prepared for electron microscopy and lipid analysis. Analysis of fatty acids from tobacco leaves fumigated with O3 indicated that there was no significant difference between the ozone-treated and the control plants in the relative amounts of fatty acids. This suggested that if the primary site of the O3 action was unsaturated lipids in membranes, then the amounts of affected unsaturated fatty acids were too small to be detected by gas chromatography. In support of this, characteristic electron microscopic images of membranes were observed in cells of fumigated leaves. Measurements of the length and width of the chloroplasts and the determination of axial ratios indicated that the O3 treatment resulted in shrinkage of chloroplasts. In contrast, mitochondrial changes were apprently explained in terms of ozone-induced swelling. (Author abstract modified)

42253 APTIC NO. 63946

Tashio, K., K. Tanabe, I. Kawasaki, S. Nakagawa, K. Namie, and K. Takemoto

INFLUENCES OF BREEDING ENVIRONMENT ON RESPIRATORY SYSTEM OF ANIMALS. PART I: ON THE MORPHOLOGICAL CLASSIFICATION OF LUNG POLLUTION. *(Dobutsu ni okeru shiiku kankyo no kokyuki-kei ni oyobosu eikyo (1) osen hai no keitaigakuteki bunrui ni tsuite). Text in Japanese. Dobutsuen Suizokukan Zasshi (J. Jap. Assoc. Zool. Gard. Aquariums), 15(1):6-10, 1973. 11 refs.*

Histo-morphological investigations of the respiratory systems in 415 cases of captive wild animals, including 73 mammals, nine reptiles, and 333 birds were made. When their lungs were classified according to the pollution level, almost no sedimentation of dust on mammalian lungs was found. Dust sedimentation did appear on alveolar cavities, the alveolar wall, parts surrounding the bronchi and vessels, connective tissues, and connective tissue layer under the pleura. On birds, dust sedimentation was frequently seen on the parts surrounding the tertiary and secondary bronchi. No dust sedimentation could be seen by low naked eye or histologically on reptilian respiratory systems. Although no chemical analyses were carried out, the dusts were identified as carbon powder by morphological observation, except for a few cases of birds in which the sediments giving interstitial reactions seemed to be silica.

42254 **APTIC NO. 64033**

Tate, Albert L.

LOCAL ENVIRONMENTAL EFFECTS OF A NATURAL DRAFT COOLING TOWER PLUME. *Emory Univ., Atlanta, Ga., Dept. of Biology, Thesis (M.S.), 1973, 110p. 32 refs.*

NTIS: ORO 2412-27

A field investigation of the local environmental effects of a natural draft cooling tower was conducted with emphasis on the potential for biological impact. A network of five stations was constructed at varying distances in a geographic array around the cooling tower. Ecologically similar sites were chosen. Continuous monitoring of temperature, relative humidity, dew, and weekly accumulation of precipitation gave no indication of any effects from the cooling tower plume during the 9-month study period. Analysis of experimental data was based on the geographical array of stations and proximity to the tower and took advantage of intermittent power plant operations during the study period. Station profiles during operating and non-operating days were compared. Data from seven proximal Environmental Data Service Weather Stations for the study period and the previous 12 yr were also analyzed, but no significant impact from the cooling tower was found. The importance of water during moisture stress periods was investigated by tree ring growth analysis of exposed loblolly pines. Correlation of tree ring growth to precipitation during the period May-Aug. for an 8-year comparison was 4 equals +0.96. (Author abstract modified)

42255 **APTIC NO. 63626**

Taylor, O C.

ACUTE RESPONSES OF PLANTS TO AERIAL POLLUTANTS. *Advan. Chem. Ser., no. 122:9-20, 1973. 18 refs.*

Acute symptoms of injury from various pollutants in different horticultural and agronomic groups are visible on the affected plant. Symptoms include chlorosis, necrosis, abscission of plant parts, and effects on pigment systems. The effects of the following pollutants on plants are described: sulfur dioxide, peroxyacetyl nitrate, fluorides, chlorides, nitrogen dioxide, ozone, and particulates. Minor pollutants causing damage are ethylene, chlorine, ammonia, and hydrogen chloride. Symptoms of acute injury are often used to identify the pollutant source and to estimate agricultural damage. (Author abstract modified)

42256 **APTIC NO. 64268**

Wallin, Thomas and Arne Jernelov

THE ROLE OF AIR-BORNE MERCURY FALL-OUT IN THE CONTAMINATION OF TWO LAKES STUDIED BY MASS ANALYSIS. *(Betydelsen av kvicksilvernedfall fran atmosfaren for kontamineringen av tva vastsvenska sjoar undersokt genom analys av bladmossa). Text in Swedish. Inst. for Vattenoch Luftvardsforskning, Goteborg (Sweden), Rept. B-173, 11p., Sept. 1973. 12 refs.*

Deposition of airborne mercury in the surroundings of two lakes situated in the Dalsland region in southwest Sweden was studied by analysis of mercury accumulated in the carpet-forming moss, Hypnum cupressiforme. Mercury concentration in the moss was determined by neutron activation analysis. Fish caught in the lakes showed high mercury levels, although there were no known discharges of mercury into these water systems. The mercury level in the moss from the investigated region was significantly higher than in that from the northeastern parts of Sweden. This indicates a higher fallout of airborne mercury in the Dalsland region, which consequently pollutes the lakes. The investigated lakes were oligotrophic, i.e., had a small bio-mass in which additional mercury may be distributed. This, together with low pH preventing formation and subsequent departure of volatile mercury compounds, contributes to an accumulation of mercury in the organisms.

42257 **APTIC NO. 63711**

Yamasaki, Morimasa and Kiichi Nishiyama

ON THE RELATIONSHIP BETWEEN THE TOLERANCE TO SO2-GAS AND TOXICITY TO KCLO3 OF MANY KINDS OF TREES. *(Jumokurui no aryusan gasu teikosei to ensosan kari teikosei tono kankei ni tsuite). Text in Japanese. Tokyo Nogyo Daigaku Nogaku Shuho (J. Agric. Sci., Tokyo Univ. Agric.), 18(2):117-122, 1973. 9 refs.*

Branches from broad-leaved, evergreen broad-leaved, and coniferous trees were put in pots filled with 0.05% solution of potassium chlorate and judged for injurious symptoms as revealed by leaf lesion and coloring in a study of KClO3 resistance as compared to sulfur dioxide resistance. The results indicated a close positive correlation between KClO3 and SO2 resistance, and it is therefore convenient to use KClO3 as a substitute for the SO2-gas method in SO2 resistance studies. Other experiments involving trees transported from various regions of varying temperature were used to show that trees from warmer regions are generally more resistant to KClO3 than those from cooler localities. Trees transported from warmer regions may be assumed to be generally more resistant to SO2-gas than those from cooler areas.

42258 **APTIC NO. 64318**

Kanagawa Prefectural General Agricultural Research Inst.

THE EFFECTS OF METAL COMPONENTS IN DUSTS ON TREES. *(Baijinchu no kinzoku seibun no jumoku e no eikyo). Text in Japanese. In: The 1972 Investigation of Air and Water Pollution on Human Health by the Chiba Prefectural Government, Department of Hygiene. Rept. 15, p. 204-210, Feb. 1973.*

The annual average of settling particles in the central Kawasaki is 41.3 tons/sq km/mo, of which 22.7 tons are nonsolubles. February, May, and July are the dustiest months, and the average reaches 70 tons/sq km/mo, and a maximum of 40 tons are nonsolubles, especially toward summer. Three kinds of evergreen and three kinds of deciduous trees were examined to see the metal components in the dusts and their effects on leaf growth in various parks of Kawasaki. The metal content was the highest in a park in the industrial area, followed by parks in the commercial and residential areas. The content of iron and manganese in the commercial and residential areas was 40-50% of that of the industrial area, and zinc, lead, copper, and nickel were 70-80% of the industrial area. Generally, the difference between commercial and residential areas was small, but those of Cu and Ni compositions were slightly greater, and there were no geographical differences at all for Cadmium. The metal adsorption on tree leaves is difficult to estimate, but monthly averages may be 400- 1600 mg/sq m in the industrial area, 200-1400 mg/sq m in the commercial area, and 100-800 mg/sq m in the residential area. The amount of adsorption seemed to be the greatest for gingko trees among the deciduous species, and for the coral tree, pasania, and sweet oleander among the evergreens. The highest metal content in washed leaves is Fe, followed by Mn, Zn, Pb, Cu, Ni, and Cd. The Mn and Zn contents are about 10% of Fe, and the Pb, Cu, and Ni contents are about 10% and the Cd content is about 1% of Mn and Zn. The ratio of Fe in the industrial area is much greater tha that in other areas. In the industrial area, the growth rate of the young leaves of zelkova and gingko trees seemed to be much smaller than those of the two other areas, especially between spring and summer. The growth rate was the highest in the residential area. There was a definite correlation between the tree damage and the metal components in leaves. Complex effects of sulfur dioxide and other gases and the metal components in settling particles must be studied further.

1972

42259 **APTIC NO. 65933**

Adedipe, N. O., R. E. Barrett, and D. P. Ormrod

PHYTOTOXICITY AND GROWTH RESPONSES OF ORNAMENTAL BEDDING PLANTS TO OZONE AND SULFUR DIOXIDE. *J. Amer. Soc. Hort. Sci., 97(3):341-345, 1972. 11 refs.*

No appreciable signs of phytotoxicity were observed for 4 days following fumigation of plants including begonias, petunias, and snapdragons with ozone up to 80 pphm or sulfur dioxide up to 400 pphm for 2 hr. Thereafter, there was considerable necrosis, particularly on begonias fumigated with the highest concentration of the pollutants. Growth suppression was reflected in reduced shoot and flower weight, and to a lesser degree in reduced flower number. Overall, begonias and petunias were the most sensitive. Coleus and snapdragons were moderately sensitive, while marigold, celosia, impatiens, and salvia, were tolerant. White Tausendschon was the most sensitive begonia cultivar, while blue-flowered Capri was the most sensitive petunia. Mixed color petunias exhibited varying degrees of tolerance. Scarlet Rainbow coleus was more sensitive than Pastel Rainbow. Measurements of growth alterations in plants were very useful in determining latent forms of air pollutant injury. (Author abstract)

42260 **APTIC NO. 63536**

Bolter, E., D. Hemphill, B. Wixson, D. Butherus, and R. Chen

GEOCHEMICAL AND VEGETATION STUDIES OF TRACE SUBSTANCES FROM LEAD SMELTING. *Missouri Univ., Columbia, Environmental Trace Substances Center and Extension Div., Trace Subst. Environ. Health, Proc. Univ. Mo. Annu. Conf., 6th, Columbia, Mo., 1972, p. 79-85. 7 refs. (June 13-15.)*

Several hundred soil and vegetation samples from the Viburnum Trend or New Lead Belt of Southeastern Missouri were analyzed for lead, zinc, copper, cadmium, manganese, and total sulfur to determine natural background concentrations and to delineate areas of anomalous high concentrations caused by the mining and lead smelting activity. The area around one lead smelter showed anomalous high heavy metal concentrations for a distance of several miles. Other activities, such as the transport of ore concentrate in open trucks or by railroad, also act as sources of pollution. Elevated heavy metal concentrations in soils were mainly restricted to the humus layer on the surface of the soil and to the top 1-inch soil layer. Most of the lead found in vegetation samples was present on the surface of the leaves.

42261 **APTIC NO. 64166**

Daessler, H. G., H. Ranft, and K. H. Rehn

THE SUSCEPTIBILITY OF WOODY PLANTS EXPOSED TO FLUORINE COMPOUNDS AND SO2. *(Zur Widerstandsfaehigkeit von Gehoelzen gegenueber Fluorverbindungen und Schwefeldioxid). Text in German. Flora (Jena), 161(3):289-302, 1972. 11 refs.*

The susceptibility of 80 woody plant species to fluorine compounds was studied in fumigation chambers and in a test area around a major fluorine emission source, and the results are compared with those of previous sulfur dioxide toxicity tests. The hydrofluoric concentrations in the Chambers ranged from 0.3 to 0.5 mg/cu m. Juglans regia, Vitis vinifera, Pinus silvestris, Berberis vulgaris, Rhododendron japonica, Picea abies, and Larix decidua were the most susceptible species to HF. Taxus baccata, Tilia cordata, Alnus incana, Ribes sanguineum, Salix elaeagnus, Populus regenerata Harff, Carpinus betulus, Pinus Strobus, Pinus nigra austr., Potentilla fruticosa arb., Castanea sativa, Lonicera tatarica, Larix leptolepsis, and Picea pungens were classed as fluorine-susceptible, while such species as Pinus montana, P. contorta, Cornus alba sib., Prunus cerasifera Piss., Ulmus campestre, Alnus glutinosa, Buxus sempervirens, Pinus peuce, Syringa japonica, Acer Negundo, Robinia pseudoacacia, Ailanthus altissima, Fagus silvaticus, Populus candicans, Fraxinus excelsior, Humulus lupulus, Crataegus monogyna, Salix aquatica, Spiraea vonhouttei, Platanus acerifolia, Quercus borealis, Betula pendula, Prunus serotina, Viburnum carlesii, and Hydrangea pan. were moderately susceptible to HF. Juniperus squamata m., Laburnum anagyroides, Viburnum lantana, Tamarix tetr., Spiraea bum. A. Wat., Elaeagnus angustifolia, Weigelia hybr. Ruby, Rosa rugosa, and Synringa vulgaris were relatively resistant. Very high resistance of such species as Acer campestre, Acer platanoides, Evonymus europaea, Philadelphus coronarius, Quercus robur, and Sambucus racemosa was determined. Intercostal necroses, and necroses on the edges and apices of the leaves and needles were the common symptoms of fluorine damage. The overwhelming majority of the species investigated had identical or comparable susceptibility to both fluorine and SO2.

42262 **APTIC NO. 63583**

Harger, J. Robin E.

DAMAGE TO VEGETATION BY CHLORINE GAS. *Int. J. Environ. Studies, vol. 1:93-108, 1972. 13 refs.*

Chlorine gas released accidentally from a Chlor-Alkali plant (mercury cell process) resulted in extensive damage to vegetation downwind of the factory situation at the head of Howe Sound in British Columbia. Within 1 mi downwind of the plant, most species comprising the emergent vegetation in the area experienced between 30 and 90% foliage damage. Individual species demonstrated differing sensitivity as did individual organisms. Damage indicative of the presence of chlorine gas was detected up to 11 mi downwind from the release point. The destruction of foliage decreased with distance from the spill sight. Three 4-month-old rabbits, housed outside 1 mi north of the plant died 4 days after the spill. (Author abstract modified)

42263 **APTIC NO. 64282**

Jones, L. H. P., D. W. Cowling, and D. R. Lockyer

PLANT-AVAILABLE AND EXTRACTABLE SULFUR IN SOME SOILS OF ENGLAND AND WALES. *Soil Sci., 114(2):104-114, 1972. 26 refs.*

Investigations were made by soil and pot-culture procedures of the sulfur status of 16 soils in England and Wales. One group of soils was from the wetter, western region with an annual rainfall above 900 mm and the other group was from the drier, central and eastern region. An organic soil from the dry region had unusually high levels of organic sulfur (.7%) and extractable sulfate and was the only soil to meet fully the sulfur requirements of experimental plants. The soils from the wet region had higher contents of organic carbon and sulfur, higher contents of free iron oxides, lower pH values, and higher contents of absorbed sulfate than soils from the dry region. The available sulfur was assessed by measuring the total uptake by perennial ryegrass in pots in a growth chamber with the air filtered to exclude gaseous sulfur compounds. Available sulfur was generally greater in soils of the wet region and was highly correlated with the amounts of soluble plus adsorbed sulfate originally present in the soils and extractable with potassium phosphate solution. The decreases in this fraction during the growth period accounted for 80-94% of the available sulfur, and release through mineralization contributed the remainder. higher levels of available sulfur in the wet region were due to their greater retention of sulfate by adsorption rather than to any difference in previous sulfur inputs through rainfall and fertilizers. The pot-culture experiment included a treatment with added sulfate; the yield of dry matter at each of the harvests was used as a basis for calculating the reduction in yield due to sulfur deficiency. Significant reductions of more than 10% were generally associated with sulfur contents in the plant tops of 0.17% or less. The ratios of total nitrogen to total sulfur in the tops ranged from 8 to 80 and were generally less than 15 until yields were reduced by sulfur deficiency. (Author summary modified)

42264 **APTIC NO. 63533**

Lagerwerff, J. V., D. L. Brower, and G. T. Biersdorf

ACCUMULATION OF CADMIUM, COPPER, LEAD AND ZINC IN SOIL AND VEGETATION IN THE PROXIMITY OF A SMELTER. *Missouri Univ., Columbia, Environmental Trace Substances Center and Extension Div., Trace Subst. Environ. Health, Proc. Univ. Mo., Annu. Conf., 6th, Columbia, Mo., 1972, p. 71-78. 18 refs. (June 13-15.)*

The occurrence of the elements cadmium, copper, lead, zinc, and manganese in soils, and the first four elements in natural vegetation (grass) is studied, with samples taken in an area of about 10 sq mi located mostly to the north of the smelter. The concentrations of Cd, Cu, Pb and Zn in soils and plants decreased with increasing distance from the smelter, indicating the possible location of the source. Analysis of the soil profile established a negative relationship between metal concentration and depth. This suggests an aerial origin of the contamination. Soil samples were also collected in enclosed spaces under houses (protected soil), as well as around these houses (unprotected soil). The average ratios between the metal concentrations in the 0-20 centimeter layers of unprotected soil and comparable metal concentrations in the protected soil are 7.0 for Cd, 2.9 for Cu, 2.0 for Mn, 2.3 for Pb and 4.8 for Zn. These values serve as a general measure depicting the metal accumulation in the exposed soil. Coupled with the low pH, a deterioration of the quality of the soil in a region with a high native metal background level is indicated. Heavy metal accumulation in surface soil resulting from aerial contamination, in conjunction with high native background concentrations and low pH levels that favor solubility and plant uptake, may have caused the presence of an environmental hazard. Uptake of these heavy metals by plants may cause extensive toxicity to vegetation and human health.

42265 **APTIC NO. 63803**

Miyake, Yoshiyuki and Yoshio Uno

STUDIES ON PHYSIOLOGICAL TOBACCO LEAF SPOT (I). INVESTIGATION OF PHYSICAL AND CHEMICAL PROPERTIES BETWEEN OZONE-SUSCEPTIBLE TOBACCO LEAF AND OZONE-RESISTANT TOBACCO LEAF. *(Tabako no seiriteki hanten shogai ni kansuru kenkyu (daiippo). (Tsugiki ni yoru Bel w3-S, -R no ozone kanjusei to tainai seibun to no kanren). Text in Japanese. Utsunomiya Tabako Shikenjo Hokoku (Bull. Utsunomiya Tob. Exp. Stn.), no. 11:1-6, Nov. 1972. 11 refs.*

An ozone-susceptible tobacco species (Bel W3-S) and an ozone-resistant species (Bel W3-R) were grafted reciprocally at the topping stage and fumigated with ozone to investigate the biochemical relationship between ozone damage and physiological tobacco leaf spot. The ozone-susceptible variety was injured more severely than the ozone-resistant variety by ozone fumigation, with leaf injury not being influenced by the reciprocal effect. Inorganic chemical contents were lower in the susceptible variety. Total nitrogen and the ratio of insoluble nitrogen to total nitrogen were also lower in the susceptible species. The degree of ozone damage to the leaves appeared to be associated with the contents of nitrogenous compounds and inorganic leaf components.

42266 **APTIC NO. 63804**

Miyake, Yoshiyuki and Yoshio Uno

STUDIES ON PHYSIOLOGICAL TOBACCO LEAF SPOT (II). RELATIONSHIP BETWEEN OZONE LEAF DAMAGE AND NITROGENOUS COMPOUNDS IN FLUE-CURED TOBACCO LEAF. *(Tabako no seiriteki hanten shogai ni kansuru kenkyu (dainiho). (Oshokushu tabako no ozon shogai to tainai chisso kagobutsu to no kanren ni tsuite). Text in Japanese. Utsunomiya Tabako Shikenjo Hokoku (Bull. Utsunomiya Tob. Exp. Stn.), no. 11:7-13, Nov. 1972. 19 refs.*

Leaves from four tobacco varieties at the topping stage were fumigated with 40 pphm of ozone for 3 hrs to investigate the biochemical relationship between ozone leaf damage and nitrogenous compounds in flue-cured leaves. The leaves of ozone-susceptible varieties showed low levels of chlorophyll (a plus b) and insoluble nitrogenous compounds. Total glutathione content was higher in the ozone susceptible varieties than in ozone-resistant ones, whereas content of protein-thiol groups was lower in ozone-susceptible varieties. The contents of glutathione and protein-SH groups in tobacco leaves are concluded to play an important role in ozone leaf damage.

42267 **APTIC NO. 63805**

Miyake, Yosiyuki and Yosio Uno

STUDIES ON PHYSIOLOGICAL TOBACCO LEAF SPOT (III). RELATIONSHIP BETWEEN CONTENT OF GLUTATHIONE IN TOBACCO LEAF AND OZONE LEAF DAMAGE. *(Tabako no seiriteki hanten shogai ni kansuru denkyu (Daisanpo). (Tabako Tainai no gurutachion nodo to ozon ni yoru seiri shogai hasseido to no kaarensei ni tsuite). Text in Japanese. Utsunomiya Tabako Shikenjo Hokoku (Bull. Utsunomiya Tob. Exp. Stn.), no. 11:15-22, Nov. 1972. 11 refs.*

Results are presented from studies investigating the relationship between gluthtione content in tobacco leaf and ozone damage to the leaf. The topping stage of tobacco leaf growth appeared to be the most susceptible stage to ozone damage, with total glutathione levels at this stage being the highest. Ozone fumigation resulted in a lowering of the reduced glutathione in tobacco leaf, though at night the reduced- glutathione returned to normal levels. The level of oxidized glutathione increased temporarily as a result of ozone fumigation, with oxygen uptake and glutathione patterns of the leaves showing a similar tendency. The results suggest an association between the content of glutathione and tobacco leaf respiration and the occurrence of ozone leaf damage.

42268 **APTIC NO. 63806**

Uno, Yoshio and Yoshiyuki Miyake

STUDIES ON PHYSIOLOGICAL TOBACCO LEAF SPOT (IV). ETHYLENE PRODUCTION ON PHYSIOLOGICAL TOBACCO LEAF SPOT. *(Tabako no seiriteki hanten shogai ni kansuru denkyu (Daiyonho). (Hanten shogai to echiren no seisei). Text in Japanese. Utsunomiya Tabako Shikenjo Hokoku (Bull. Utsunomiya Tob. Exp. Stn.), no. 11:23-27, Nov. 1972. 12 refs.*

Tobacco leaf ethylene production was examined in relation to leaf spot caused by ozone exposure. Ethylene production was positively correlated to the appearance of leaf injury and exhibited peak levels at 2 to 4 hrs after ozone exposure. Ethylene production increases and correlations with ozone concentrations differed with different tobacco varieties.

42269 **APTIC NO. 65001**

Eber, J.

LEAD IN TOBACCO SMOKE. *In: Lead and Environment 1972. West German Federal Ministry of Health, Commission for Environmental Dangers Lead Working Group. Translated from German, p. 102-104, 1972. 10 refs.*

Various studies concerning the amount of lead in cigarette tobaccos and cigarette smoke are cited. Lead values are tabulated for flue-cured, air-cured, and burley types of tobacco and range from 5.6-7.0 micrograms/cigarette for the tobacco and 0.01-0.03 micrograms/cigarette for the smoke. The transition from the cigarette tobacco to the smoke is given as less than 0.5% and is dependent on the smoking conditions.

1971

42270 **APTIC NO. 64208**

Hodges, G. H., H. A. Menser, Jr., and W. B. Ogden

SUSCEPTIBILITY OF WISCONSIN HAVANA TOBACCO CULTIVARS TO AIR POLLUTANTS. *Agron. J., 63(1):107-111, Jan./Feb. 1971. 16 refs.*

Wisconsin Havana cigar tobacco cultivars were tested for susceptibility to air pollutants in a plant exposure chamber and in tobacco field. Gases used in the chamber were ozone, sulfur dioxide, and a mixture of the two. Ozone was the principal air pollutant to affect field grown plants. Havana 142 was the most susceptible cultivar to ozone fumigations and to ozone-induced field disorder, weather fleck. Havana 501 exhibited about half the leaf injury of Havana 142 when exposed to the same ozone conditions. Other cultivars that showed intermediate response were Havana 307, Havana, 425, and Havana 503. No injury resembling Target Spot a nonpathogenic syndrome observed in Wisconsin on Havana 503, was produced in any of the tests. All injury resembled the ozone fleck consisting of punctate lesions on upper surfaces of mature leaves. A low concentration mixture of ozone (0.03 ppm) and sulfur dioxide (ca. 0.45 ppm) caused from 5 to 15% injury, but individual gases used at the same rates caused no symptoms. Mixed gas injury differed very little from ozone flecks. (Author abstract)

42271 **APTIC NO. 64100**

Hutchinson, T. C.

THE OCCURRENCE OF LEAD, CADMIUM, NICKEL, VANADIUM, AND CHLORIDE IN SOILS AND VEGETATION OF TORONTO IN RELATION TO TRAFFIC DENSITY. *Preprint, Canadian Botanical Assoc. and American Inst. of Biological Sciences, 27p., 1971. 21 refs. (Presented at the Canadian Botanical Association and the American Institute of Biological Sciences, Joint Meeting, Alberta, June 20-24, 1971.)*

From June to August 1970, soil and plant samples were taken at eight sites around Metropolitan Toronto. The sites were selected to give a wide range of traffic density and degree of urbanization. Surface soil, soil from a 2-3 in. depth, and soil from a 5-6 in. depth were collected, and replicate samples were taken at distances from 0 to 30 m from the road edge. Total concentration of lead, cadmium, nickel, vanadium, and chloride in the soils and plant samples were determined. The toxicity of particular metallic salts was determined using root elongation as a bioassay technique. High levels of lead occurred in soils and vegetation in downtown Toronto. The pattern of distribution was clearly indicative of traffic source. Cadmium showed a similar distribution, although at much lower levels. Levels of Pb and Cd in soils were inhibitory to plant growth; laboratory studies showed that Cd and Pb were taken up to a a great extent by roots, and that uptake correlated to inhibition. Lead and cadmium levels in trees increased several fold over the last 100 years, and the greatest increase occurred since 1940. Vanadium and nickel accumulated in surface soils with the lowest concentrations at the rural site. Nickel correlated with distance from the highway. The source was anthropogenic. High chloride concentrations near roads were due to road salting operations. Chlorides caused damage to grasses and trees near roads. (Author conclusions modified)

42272 **APTIC NO. 64084**

Miller, Paul Robert and Arthur A. Millecan

EXTENT OF OXIDANT AIR POLLUTION DAMAGE TO SOME PINES AND OTHER CONIFERS IN CALIFORNIA. *Plant Disease Reptr., 55(6):555-559, June 1971. 10 refs.*

The incidence of oxidant air pollution damage was investigated on 16 native conifer species in California during a 3-year period. The most serious damage was to Pinus ponderosa, P. jeffreyi, P. coulteri, P. radiata, and Pseudotsuga macrocarpa in the south coast and adjoining portions of the southeast air basins including the Angeles, San Bernardino, and Cleveland National Forests. P. attenuata was slightly affected in the south coast basin. Suspected oxidant injury symptoms were also observed on P. contora, P. lambertiana, P. torreyana, Abies concolor, and Libocedrus decurrens. No injury was observed on P. sabiniana, P. monophylla, Juniperus occidentalis, Sequoia gigantea, and S. sempervirens. Choose-and-cut Christmas tree farms, utilizing mostly P. radiata, experienced significant oxidant injury. The potential for new, severe forest damage is located in the mixed conifer forests bordering the east side of the San Joaquin Valley air basin and also in scattered stands in the San Francisco Bay and north central coast air basins. (Author abstract)

42273 **APTIC NO. 65928**

Palm, Einar W.

WHAT AIR POLLUTION DOES TO YOUR PLANTS. *Crops Soils Mag., 23(4):14-17, Jan. 1971.*

The effects of air pollutants upon plants are summarized. Plants that are sensitive or resistant to sulfur dioxide, fluoride, chloride, nitrogen dioxide, ozone, oxidants, ethylene, and particulates are listed. The damage that smog and other pollutants do to plants often looks like the damage done by diseases, insects, and nutritional imbalances. The various pollutants do not act the same way on each plant. Some pollutants, such as O3, will react differently on different species or even varieties of the same plant species.

1968

42274 **APTIC NO. 64150**

Lundstrom, Hans

THE EFFECT OF AIR POLLUTION ON THE EPIPHYTIC FLORA OF CONIFERS IN THE STOCKHOLM REGION. *(Luftfororeningars inverkan pa epifytfloran hos barrtrad i Stockholmsomradet). Text in Swedish. Stud. Forest. Suec., no. 56:1-55, 1968. 52 refs.*

Epiphytic flora of conifers in the Stockholm region were investigated to see how they respond to air pollution. Three groups of lichens are apparent in terms of their relation to air pollution: species enduring air pollution in moderate quantities, e.g., Lecanora conizaeoides and Lecidea scalaris; species sensitive to air pollution and not found in areas exposed to air pollution for long durations; and the remainder of lichens which can be subdivided into those species growing close to the ground and sheltered by snow in the winter and species that may be affected by air pollution but can survive injuries within certain limits. The atmospheric algae Protococcus ciridis is only slightly affected by air pollution.

1967

42275 **APTIC NO. 63602**

Koukol, Jane, W. M. Dugger, Jr., and R. L. Palmer

INHIBITORY EFFECT OF PEROXYACETYL NITRATE ON CYCLIC PHOTOPHOSPHORYLATION BY CHLOROPLASTS FROM BLACK VALENTINE BEAN LEAVES. *Plant Physiol., 42(10):1419-1422, 1967. 12 refs.*

The inhibitory effect of peroxyacetyl nitrate (PAN) which causes damages to plants by interfering in both photosynthetic and nonphotosynthetic processes on cyclic photophosphorylation by chloroplasts obtained from Black Valentine variety bean leaves is studied in detail. Peroxyacetyl nitrate could oxidize sulfhydryl groups on enzymes necessary for photophosphorylation. The inhibition to photophosphorylation caused by PAN cannot be reversed by glutathione, even when added in large amounts, whereas the inhibition to photophosphorylation caused by para-chloromercouriphenylsulfonic acid is easily reversed by small quantities of glutathione. If PAN is oxidizing sulfhydryl groups necessary for photophosphorylation, this oxidation is proceeding beyong the disulfide stage.

1966

42276 **APTIC NO. 63522**

Krueger, A. P., S. Kotaka, K. Nishizawa, Y. Kogure, M. Takenobu, and P. C. Andriese

AIR ION EFFECTS ON THE GROWTH OF THE SILKWORM (BOMBYX MORI L.). *Intern. J. Biometeorol., 10(1):29-38, 1966. 18 refs.*

The exposure of silkworm eggs to unipolar ionized atmospheres of either a + or a - charge at 24 and 26 C induced an earlier onset of hatching. Continued treatment of the larvae produced the following physiological effects: A marked increase in the rate of larval growth; increased biosynthesis of catalase, peroxidase, and cytochrome c oxidase; earlier onset of spinning; and a significant increase in the weight of the cocoon at 24 and 26 C. At 24 C, treatment with either + or - ions caused a statistically valid increase in pupal weight, but at 26 C this occurred only after + ion treatment. At both 24 and 26 C, exposure to air ions of either charge resulted in development of heavier silk layers, but the increases were not statistically significant. (Author abstract)

1964

42277 **APTIC NO. 63442**

Gisiger, L.

EXPERIMENTAL STUDY OF FLUORINE DAMAGES IN PLANTS. *(Versuche zur experimentellen Abklaerung der Fluorschaeden auf Pflanzen). Text in German. In: Toxicologie des Fluors. T. Gordonoff (ed.), Basel/Stuttgart, Verlag Schwabe and Co., 1964, p. 164-178. 4 refs.*

The fluorine-inflicted plant damages as occur near aluminum works were studied in pot tests on winter wheat and clover. Plant grown in soil to which sodium and potassium fluorides had been added took up less fluorides, and these fluorides were less soluble than in soils to which the corresponding cryolites had been added. Fluoride doses of up to 180 mg% caused no noticeable loss in yield. Spraying the plants with fluoride solutions resulted in high fluorine contents on the leaves reaching up to 1% without noticeable loss in crops and necrosis. In plants sprayed with fluorides in field tests, damages similar to those occurring in fluorine-polluted areas were observed in rainy weather. Discoloration of the glumes resembling Septoria, and losses in crops occurred in winter wheat sprayed with high concentrations of sodium fluoride solution during the late stages of flowering. Slow increase in the degree of necrosis of the leaf edges in clover smoked with 0.25% hydrofluoric acid by volume for several nights was observed. At the same time, the fluorine content in the leaves increased from a background value of 2.6 mg% to 64 mg% after one treatment, to 104 mg% after two treatments, and to 360 mg% after eight treatments.

1962

42278 **APTIC NO. 63513**

Nasek, J. and K. Hais

PRELIMINARY STUDY ON THE INFLUENCE OF INDUSTRIAL EXHALATIONS UPON THE HEALTH CONDITION AND PERFORMANCE OF CATTLE. *Czechoslovak Academy of Sciences, Aerosols, Phys. Chem. Appl., Proc. Nat. Conf. 1st, Liblice, Czechoslovakia, 1962, p. 807-817. 92 refs. (Oct. 8-13.)*

The effects of industrial emissions upon livestock were investigated for 1 year. The general health condition, weight increases, milk production, and milk fat content were checked. Effects of air pollution on the respiratory and digestive systems are briefly noted. The quantities of erythrocytes and hemoglobin were examined, and evaluations of smears were made. Of the electrophoretical fractions, glutamic-pyruvic transaminase (SGP-T) activity, some flocculation reactions, and the amount of sodium, potassium, calcium, and inorganic phosphorus, together with their respective coefficients, are examined. In the case of hay covered with dust, attention is paid to an estimation of the ash and sand content. Al investigations were performed under such conditions as to eliminate the interfering influence of geographical environment, different feed rations, age, and the breed of control and experimental animals.

1960

42279 **APTIC NO. 65892**

Bentley, H. R. and J. G. Burgan

POLYNUCLEAR HYDROCARBON IN TOBACCO AND TOBACCO SMOKE PART II. THE ORIGIN OF 3:4-BENZOPYRENE FOUND IN TOBACCO AND TOBACCO SMOKE. *Analyst, vol. 85:723-727, 1960. 2 refs.*

The origin of 3:4-benzopyrene found in tobacco and tobacco smoke was investigated. Unsmoked cigarette tobacco contains 3:4 benzopyrene in amounts approximately equal to the amounts of the hydrocarbon found in the main stream smoke from an equal weight of cigarettes. It is not present as the pure hydrocarbon, but as part of the complex mixture of substances that together comprise the particles of soot and dust adhering to the surface of the leaf. In the flue curing process the leaf is exposed to gases escaping from faulty flues and these gases which are the products of the incomplete combustion of wood, coal, or oil are a source of contamination with 3:4-benzopyrene. In the subsequent re-drying process, large volumes of air are blown through the cured leaf, and the leaf is exposed to further contamination by atmospheric soot and dust. The presence of the hydrocarbon in cigarette smoke is due mainly to synthesis in the burning cigarette.

EFFECTS-MATERIALS

1974

42280 **APTIC NO. 63678**

Duncan, J. R.

ANALYSES OF SOME SUGGESTED MECHANISMS FOR ATMOSPHERIC CORROSION OF IRON IN PRESENCE OF SO2. *Werkstoffe Korrosion, 25(6):420-424, June 1974. 26 refs.*

Two established theories of sulfur dioxide/atmospheric corrosion of iron, the acid regeneration cycle and an electrochemical model, are reviewed in terms of recently reported experimental results. Theoretical analyses of proposed electrochemical mechanisms are discussed and applied to a previously suggested mechanism, and a new one is suggested here as an extension of recently reported results. In the new mechanism the adsorption and oxidation is analogous to the first and second steps of the acid regeneration cycle. A third step is represented by an electrochemical scheme but becomes appreciable only after finite amounts of sulfate form on the surface. The contribution from the third step would then become the major path of corrosion, since the electrolyte reaction would be much more easily achieved than the adsorption/oxidation. Corrosion would continue until the sulfate in the rust was bound or a protective film formed over the metal surface.

42281 ***APTIC NO. 65935***

Feige, N. G.

TITANIUM FOR INCINERATOR GAS SCRUBBING EQUIPMENT. Mater. Performance, 13(4):17-19, April 1974. 6 refs.

The use of titanium in the construction of wet scrubbers for refuse incinerators is described. Flue gases may contain significant quantities of hydrogen chloride, sulfur dioxide, sulfur trioxide, trace hydrogen fluoride, and organic acids. The titanium is resistant to the corrosive environment in gas scrubbing equipment. Good resistance is predicted in the pH range of 1.5 to 11, and resistance to crevice corrosion at temperatures to 74 C and general pitting attack to 110 C. Trace amounts of iron 3 ions in the system or incorporated in the film should extend the range of immunity to attack. Economics of alternate materials and restrictions in performance limit Ti s application to the inlet and induced draft fan rotor assembly. Titanium can be applied where the environment is aggressive with high levels of HCl as in burning of polyvinyl chloride or when the consequences of unexpected scrubber outage can be costly or dangerous. (Author abstract modified)

42282 **APTIC NO. 63768**

Laub, Hans

ATMOSPHERIC CORROSION. *(Korrosion durch die Atmosphaere). Text in German. Galvanotechnik, 65(3):209-221, 1974. 16 refs.*

Studies on the mechanism and appearances of atmospheric electrochemical corrosion of metals due to air pollutants and other factors are surveyed. The presence of an electrolyte and potential difference are the basic requirements for corrosion to occur, while the corrosion process is accelerated by oxygen, high temperatures combined with high relative humidity, and carbonic acid. However, the rate of corrosion is determined to a great extent by the presence in the atmosphere of air pollutants, of which sulfur dioxide, hydrogen sulfide, dust, and chlorides are most aggressive. The extent of SO2-induced corrosion of zinc, nickel, and unalloyed steel correlated with the SO2 absorption. Ammonia and nitrogen oxides may promote the corrosion process either directly or indirectly after their conversion into their salts in dust. Dust, soot, and carbon particles on metal surfaces form corrosion cells.

42283 **APTIC NO. 63871**

Luckat, Siegbert

RELATIONSHIP BETWEEN THE CORROSION RATE OF STEEL AND THE IMMISSION RATE OF VARIOUS POLLUTANTS. *(Beziehungen zwischen der Korrosionsrate von Stahl und den Immissionsraten verschiedener Schadstoffe). Text in German. Staub Reinhaltung Luft, 34(6): 209-213, June 1974. 13 refs.*

Steel plates (DIN 1623) of 50 by 100 mm and 1 mm thickness were used for determination of the relationship between the corrosion rate and the emission rate of sulfur-, fluorine-, and chlorine- containing pollutants. For exposure of the steel plates Mank s turret (a pivoted disk with arms driven by the air flow) was used. The emission rate analyzer, which has been described elsewhere, uses the surface of an alkaline liquid as a standardized measurement area. The absorption solutions and Soxhlet-cartridges of the analyzers were collected every two weeks and replaced by new ones. The emission rate was likewise determined every two weeks by replacement of the five exposed steel plates by fresh ones. The weight loss of the exposed plates was determined in the laboratory and the corrosion calculated in grams per sq meter per day. The heavily polluted cities Duisburg, Essen and Herten of the Ruhr valley and Haus Alst outside of the industrial area were selected as exposure sites. The seasonal characteristic of the sulfur dioxide emission rate showed for all measuring sites two to 2.5 times higher values in the winter months than in summer. The concentrations of SO2 in Haus Alst, whose maximum values corresponded to the minimum values measured in Duisburg were surprisingly high. The chloride emission rate showed no marked seasonal characteristic. Several considerable peak values which occured at the same magnitude at all sites deserve mentioning. Fluoride emission rates, too, show no significant seasonal seasonal fluctuation with the exception of the measuring site at the cathedral in Cologne where the values increase significantly during the summer months. The annual average values here are far above those measured in the Ruhr valley. The seasonal characteristic of the corrosion rates corresponded to that of the SO2 emission rates which shows that the corrosion rate of steel can be used as a criterion for the effect of air pollutants. Correlation coefficients will be calculated as soon as more data are available.

42284 **APTIC NO. 66082**

Michels, H. T.

CORROSION PERFORMANCE OF HEAT-RESISTING ALLOYS IN AUTOMOBILE EXHAUSTS. *Metals Eng. Quart., 14(3):23-35, Aug. 1974. 5 refs. (Presented at the Society of Automatic Engineers Automotive Congress, Detroit, Mich., Feb. 2-5, 1974.)*

The corrosion performance of several commercial heat-resisting austenitic and ferritic alloys is evaluated from 1300-2000 F in cyclic air plus 10% water vapor and in gasoline engine exhaust gas from 1300-1800 F. The results of both the oxidation and engine tests indicate that increasing nickel content improves the oxidation of performance of austenitic alloys, with the latter as a group possessing oxidation resistance superior to that of ferritic alloys. The presence of nickel tends to impart higher spallation resistance to the alloy. Engine exhaust is the most aggressive on either type of alloy, the effect of being due to the passing of the gas over the alloys at a relatively high velocity (20-30 ft/sec).

42285 **APTIC NO. 64337**

Pitrou, J.

THE USE OF LEAD FOR PROTECTION AGAINST CORROSION AND AIR POLLUTANTS. *(Emplois du plomb pour la protection contre la corrosion et les agents atmospheriques). Text in French. Mater. Tech., 62(11-12):31-35, Jan./Feb. 1974.*

The use of lead as protection against corrosion and air pollution are presented. The lead resistance to atmospheric agents is exceptional. In contact with atmospheric humidity, lead forms a coating of lead carbonate and hydrate which protects it from deterioration. Lead is also resistant to sea water. The rate of deterioration varies from 2 to 15 micrograms/yr. Lead resists damage from different soils and chemical products such as sulfuric, phosphoric, chromic, and hydrochloric acid. It does not resist nitric and organic acids, nor diluted caustic alkali. It is especially resistant to sodium chloride, sodium carbonate, ammonia, and magnesium sulfate. Historical monuments, buildings located near busy traffic arteries, buildings in industrial areas, and maritime urban developments are covered with lead to protect them from corrosion. Lead sheets are often used for roofing. Lead is an effective protective material for piping systems of sanitary installations, underwater electrical and telephone cables, test tubes in laboratories and chemical industries, and containers for radioactive substances. Coating techniques are discussed. The properties of lead oxide for the protection and conservation of iron make it especially valuable. Lead is mixed into various paints in the form of lead powders containing 97% lead and 3% antimony.

1973

42286 **APTIC NO. 65957**

Gauri, K. L. and Atul C. Sarma

CONTROLLED WEATHERING OF MARBLE IN A DYNAMIC SO2 ATMOSPHERE. *Louisville Univ., Ky., Speed Scientific School, Environ. Eng. Sci. Conf., Proc.*

3rd Annu. Meet., Louisville, Ky., 1973, p. 209-223. 10 refs. (March 5-6.)

Specimens representing several textural varieties of marble were reacted with dynamic sulfur dioxide-atmospheres at ambient temperatures but with variable conditions of flow rate, humidity, and SO2 concentrations. The products of reaction of marble with such atmospheres were quantitatively determined by X-ray diffraction. Calcium sulfite .2 water is the main product formed under normal humidity conditions. In high humidity the first product of reaction is still CaSO3, but it oxidized to calcium sulfate .2H2O progressively with increasing time of exposure. The rate of reaction is directly related to SO2 concentration and inversely related to the rate of flow of the dynamic atmosphere. Laboratory data on stone deterioration can be tentatively correlated with the weathering of stone due to SO2 in natural conditions. Specimens treated with a variety of epoxy resins reveal a variable degree of protection from SO2 attack. While certain epoxies enhanced the reactivity, others suppressed it as much as 7% as compared with 100% reactivity of an untreated specimen. (Author abstract modified)

42287 **APTIC NO. 63462**

Johnson, K. E. and A. F. Bromley

APPARATUS FOR STUDYING ATMOSPHERIC DEGRADATION OF MATERIALS. *British Steel Corp., Sheffield (England), Corporate Development Lab., CEL/CH/34/73, 12p., Oct. 1973. 7 refs.*

NTIS: PB-225 717

A simple, flexible test facility was devised which is suitable for examining the effects of trace gases on the degradation of materials under conditions approximating to those of free atmospheric exposure. The apparatus described here is designed to study the effects of controlled atmospheric levels of sulfur dioxide (up to 0.15 ppm) on specimens inoculated with solid contaminants of the type found in the atmosphere using a system of air dosed with known levels of SO2 flowing continuously through the test chamber. The system overcomes the problems of obtaining accurate low doses of gas and absorption of the test gas by the walls of the test vessel. It uses a flowing air system, is cheap, easily maintained, and capable of producing test atmospheres with a choice of two levels of SO2 concentration. The apparatus consists of an air cleaning system, test chambers, dilution apparatus, and an SO2 monitoring apparatus.

42288 **APTIC NO. 65880**

Johnson, K. E. and A. F. Bromley

APPARATUS FOR STUDYING ATMOSPHERIC DEGRADATION OF MATERIALS. *Anti-Corros., 20(11):17-19, Nov. 1973. 7 refs.*

A simple, flexible test facility was devised for examining the effects of trace gases on the degradation of materials under conditions approximating free atmospheric exposure. The test facility may be used for a wide variety of studies, is simple, reliable, easy to construct and maintain, and relatively cheap, and can form a useful addition to existing laboratory test facilities. It consists of an air cleaning system, test chambers, a gas dilution system, and a sulfur dioxide monitoring system. The electroconductivity method is used to monitor SO2. Specimens are placed in the test chamber with diluted SO2. The corrosion of the materials is then determined at different SO2 levels.

1972

42289 **APTIC NO. 64027**

Spedding, D. J.

KINETIC STUDY OF THE UPTAKE OF SULFUR DIOXIDE BY ALUMINUM. *Brit. Corros. J., 7(6):281-284, Nov. 1972. 13 refs.*

The sorption by aluminum of sulfur dioxide at atmospheric concentrations is investigated using sulfur-35 sulfur dioxide. For the sulfur dioxide dosages used the uptake is always linear and strongly dependent upon humidity. The humidity dependence is bably related to the equilibrium between gas-phase water and aluminum surface water. The fraction of sorbed sulfur dioxide desorbed when the partial pressure of sulfur dioxide was reduced, increased with decreasing humidity. Freshly exposed Al takes up less SO2 than weathered Al as the surface of the latter is greater in area due to the formation of corrosion products. The increased surface area would enable a greater mass of water to be held as well as providing increased sites for the direct sorption of SO2. The rate of corrosion by SO2 probably increases as the time of exposure to the atmosphere increases, and then levels off to the point at which the surface area for SO2 sorption has become constant.

42290 **APTIC NO. 64106**

Tripathi, R. K., U. S. Agnihotri, and J. N. Nanda

PREDICTION OF THE SEVERITY OF ATMOSPHERIC CORROSION BY DISCRIMINANT ANALYSIS OF LOCAL METEOROLOGICAL FACTORS. *Brit. Corros. J., 7(5):212-215, Sept. 1972. 9 refs.*

Discriminant function analysis has been used to classify the corrosiveness of an environment into one of several broad categories, knowing the values of specified atmospheric factors. Of various combinations of meteorological factors that were tried, the following combination proved to be the most discriminating: average of daily maximum temperature in deg C, average daily maximum relative humidity, number of rainy days in a month, total rainfall in mm in a month, and average pollution (sulfur dioxide and sodium chloride in mg/sq cm/day over a month). These criteria were used to classify stations at Delhi, Bombay, and Tezpur, giving results that agreed well with those obtained in exposure trials. (Author abstract)

1971

42291 **APTIC NO. 64174**

Glowiak, B. and B. Cwynar

POLLUTION OF ATMOSPHERE WITH SULFUR COMPOUNDS AND THEIR INFLUENCE ON CORROSION. *(Zanieczyszczenie atmosfery zwiazkami siarki i ich wplyw na procesy korozji). Air Conserv. (English translation from Polish of: Ochrona Powietrza), 5(2):1-8, 1971. 9 refs.*

NTIS: TT 72-54022/2

The volatile sulfur compounds responsible for the corrosion of metals, construction meterials, and other materials most commonly found in the atmosphere are the following: hydrogen sulfide or its mixture with hydrogen; organic sulfur compounds such as mercaptans; sulfur dioxide or its mixture with sulfur trioxide; and sulfuric acid vapors. The maximum permissible concentrations of sulfur compounds in the air of industries, protected areas, and specially protected areas are listed. The factors determining the rate of corrosion in an aggressive atmosphere of sulfur compounds are discussed including the state of the surface of the metal plate, the mechanical factors in the system metal- reaction products, atmospheric conditions such as humidity and temperature, and the type and concentration of pollutant. The relationship between the corrosion rate and the sulfur dioxide concentration and ambient temperature and the rate of aluminum corrosion at different air relative humidities are discussed. The sulfuric corrosion mechanism is similar to that of oxygen corrosion. The rate of sulfuric corrosion increases with the concentration of the aggressive agent and the temperature. The course of corrosion depends on the character of the aggressive agent. The aggressive action of H2S is promoted by H2 and increases with its concentration. The rate of corrosion induced by sulfur oxides increases with humidity. Sulfur-induced corrosion causes scale of a chemical composition that depends on the metal and the temperature at which the process takes place.

1970

42292 **APTIC NO. 64049**

Stanners, J. F.

USE OF ENVIRONMENTAL DATA IN ATMOSPHERIC CORROSION STUDIES. *Brit. Corros. J., 5(3):117-121, May 1970. 28 refs.*

Examples of empirical and theoretical approaches in correlating environmental data and corrosion kinetics are described. Meteorological and pollution data related to exposure trials are collected with the specific aim of the corrosion tests in view. Several attempts have been made to refine correlations between environmental factors and overall corrosion rates by taking into acount of the influence of the main variables upon one another. Interactions between the environmental variables are important and equilibrium between the corroding surface and its environment are not to be assumed. The most important factors to measure in studies of bare metals or metal coatings are sulfur pollution chlorides, pH of rain, metal temperature, and duration of wetness. The variation of each with time must be recorded if interactions are to be adequately accounted for. The empirical approach is concerned with relating the overall range and frequency of environmental conditions over a test period, with the overall corrosion rates of given metals over an extended period of time. Its direct aim is practical forecasting of the corrosion of metals in service. The theoretical approach is concerned with the basic relationship between the environmental conditions at a particular moment in time and the concurrent, subsequent, instantaneous, or transient corrosion rates. This approach is directed towards an understanding of the kinetics of atmospheric corrosion, usually with the development of new alloys in mind. Indirectly, it can help toward impractical forecasting, but confusion of the two approaches, e.g., by using average environmental conditions in studies of corrosion kinetics or, conversely, by extrapolating directly from instantaneous corrosion rates to long-term corrosion in service, are both liable to be misleading. Either approach could lead to the possibility of modification of environments, as in warehousing, to reduce corrosion rates.

EFFECTS-ECONOMIC

1974

42293 **APTIC NO. 63669**

Baron, Seymour

COST-BENEFIT ANALYSES OF ADVANCED POWER-GENERATION METHODS. *Energy Sources, 1(2):201-221, 1974. 20 refs. (Presented at the American Power Conference, Annual Meeting, 35th, Ill., May 8-10, 1973.)*

The energy supply and demand in the U. S. are analyzed. If the U. S. is to be independent of foreign sources of energy, it must develop power-generation systems for its future growth tied to its coal resources and uranium resources based on breeding, as well as fusion and solar energy. The options available for developing energy conservation systems, however, must be tied to the environmental impact resulting from the utilization of these energy sources and to the cost for achieving minimum emissions of air, thermal, and chemical pollution. The economic benefits of various advanced power systems are discussed compared with present power-generation methods and with reference to their contribution to environmental pollution. Factors which have to be solved in the economic and the pollution area in order to achieve an acceptable power system for long-range power needs are reviewed. The research and development costs associated with these advanced power systems and the effect of their return based upon investment on the economy are discussed. Advanced power systems discussed include breeder reactors, pipeline gas for power generation, synthetic fuels with low-BTU gas, hydrogen gas fuel cells, fusion reactors, and solar power. (Author abstract modified)

42294 **APTIC NO. 65907**

Hyland, Edward J.

FACTORS AFFECTING POZZOLAN MARKETING. *Bureau of Mines Information Circ., no. 8640:114-122, 1974. 4 refs. (Presented at the International Ash Utilization Symposium, 3rd, Pittsburgh, Pa., March 13-14, 1973.)*

Factors affecting the marketing of fly ash as a pozzolan for use in concrete are discussed. It is difficult to market fly ash because most companies are not aware of the benefits of fly ash use and will resist salesmanship efforts. Aspects of fly ash marketing are discussed including who should sell the fly ash, types of contracts, and uses of fly ash. The advantages of fly ash utilization are reviewed. The basic reasons for fly ash use are economy and good quality. Fly ash can be used in highway paving, but has not been in the past. Trucking of fly ash can increase costs. Fly ash quality and availability are reviewed. Marketing fly ash as a pozzolan in concrete is a specialized job requiring specialized knowledge and good technical backup. The electric utility must exercise good quality control practices and meet shipping schedules. The power company must use fly ash in all of its own construction. With a spirit of cooperation and understanding, the power company and the fly ash marketer can go a long way to solve the problem of fly ash utilization.

42295 **APTIC NO. 63722**

Kasai, Akihiro

ENVIRONMENTAL PROBLEMS AND JAPANESE ECONOMY. *(Kankyo mondai to Nihon Keizai). Text in Japanese. Kankyo Gijutsu (Environ. Conserv. Eng.), 3(6):384-389, June 1974.*

One characteristic of the Japanese industrial structure is a highly developed heavy and chemical industrialization with high material and energy consumption. Japan is the only country in the world with a heavy and chemical industrialization rate of over 70%. The petroleum consumption if $24.9 per $1000 GNP in Japan compared to $18.9 in the U.S.A., and the total material consumption is $75.9 per $1000 GNP in Japan compared to $40.6 in the U.S.A., indicating a highly consumptive industrial structure. The daily consumption of petroleum is almost 25 times the domestic production of 2000 tons, relying heavily on a supply from the Middle East. The crude oil from the Middle East has the highest sulfur content, which results in the emission of a huge amount of sulfur dioxide. The rate of increase in energy consumption exceeds the growth rate of GNP, and the rate of increase in SO2 emission is the highest in the world. A huge consumption of petroleum is one factor contributing to air pollution, however, another decisive factor is the geographical concentration of population and industries. The population density is almost 300 times higher than that in the U.S.A. Furthermore, the budget spent on environmental concerns is about 1/3 of the other highly developed industrial countries. As long as an economy dependent on such a high energy consumption continues to grow, the problem of environmental pollution will only be aggravated. A change in the industrial structure from energy-oriented industry to knowledge-oriented industry which requires less energy consumption should be the basic policy for the future industrial plans.

42296 **APTIC NO. 63649**

McMichael, D. F.

MINING AND THE ENVIRONMENT--A GOVERNMENT VIEWPOINT. *Search, 5(1-2):41-45, Jan.-Feb. 1974. 16 refs.*

The difficulties faced by the mining industry in Australia to meet the increasingly stringent environmental quality standards are discussed. The general acceptance of the need for improvement in ambient air and water quality will require increasing government control of the nature and quantity of effluents and emissions from all industrial activities. The acceptance by the Australian Government along with other member countries of the Organization for Economic Cooperation and Development of the Polluter Pays Principle will mean that taxation and other forms of financial assistance to industry to help overcome existing pollution problems are unlikely to be widespread. The mining industry should expect to have to pay for necessary controls, and to include these costs in the market price of its products. If this results in Australian mining operations becoming unprofitable at existing world prices, mining could either be deferred or if the products could be utilized internally, they may be given tariff protection against cheaper imports in order to maintain existing employment and production capability. The Australian Treasury explored some economic implications of pollution control and argued that pollution can be adequately controlled without necessarily limiting economic growth.

42297 **APTIC NO. 63863**

Templeton, Robert E.

CHANGING COSTS AND ECONOMICS OF SO2 REMOVAL SYSTEMS. *Power Eng., 78(7):42-45, July 1974.*

Overoptimism has plagued the development of sulfur dioxide removal systems. The costs and favored types of systems have changed a good deal over the past several years. Late estimates show capital costs four times as high as 1967 estimates and operating costs three times as high. In 1967, the alkalized alumina process was the least costly control method. In 1973, limestone scrubbing was the least costly method, but its estimated costs was four times that of the alkalized alumina system in 1967. The hitory of SO2 removal, types of systems, and capital and economic costs for various SO2 removal system during different years are discussed.

42298 **APTIC NO. 64319**

Voss, A.

MAN - ENERGY - ENVIRONMENT, FIRST STEPS TOWARDS AN ALL-COMPRISING MODEL SYSTEM. *(Mensch - Energie - Umwelt, Ansaetze zu einer Gesamtanalyse). Text in German. Brennstoff-Waerme-Kraft, 26(2):67-72, Feb. 1974. 3 refs.*

The system dynamic method was used for working out a model simulating the relationships between man, energy, and environment. The system permits the analysis of the feedback in the system man-energy-environment. In feedback systems the caause-effect relationship of interweaving control circuits is expressed as coupled differential equations which are solved by finite difference methods. The model is divided into five sectors the population sector describes the changes of the population number, the industrial sector describes the basic relationships between production and investment, industrial consumption of crude material and energy and the necessary capital expenditures for power generation and procurement of the raw materials. The sector environment describes the ecological effects of human activities and permits the simulation of measures for reducing the environmental pollution. The effects of the consumption of raw material which cannot be recovered is described by the raw material sector. The last sector is the energy sector which is explained in greater detail. The energy sector describes the substituting process between the primary energy carriers coal, mineral oil, natural gas, and nuclear power. The factors influencing the substitution among the primary energy carriers were combined to three indicators (energy costs, availability, and use benefits. These indicators which serve for handling the influential parameters are evaluated and compared with each other by means of a cost/benefit functional. Some results obtained with the described model are discussed. The environmental sector of the model is presently further expanded to include models for determining the synergistic effect of pollution caused by energy conversion.

42299 **APTIC NO. 63882**

Tokyo Metropolitan Environmental Protection Research Inst. (Japan), Dept. of Investigation

AN EVALUATION OF ECONOMIC LOSSES BY POLLUTION. *(Kogai ni yoru keizaiteki sonshitsu hyoka). Text in Japanese. Kankocho Kogai senmon Shiryo (Public Nuisance Gaz.), 9(3):65-78, May 1974.*

Economic losses caused by various types of pollution were investigated between 1964 and 1972 in the Koto delta area of Tokyo. Damages were studied on roads, bridges, rivers, harbors, railroad, all public schools, electric power, gas, telephone and telegraph communication media, and public housing. With regard to household expenses directly resulted from air pollution, a questionnaire was given to the parents of third and fourth graders of 13 schools chosen at random from the 70 schools in the delta area. The total response rate was 86.8%. A total of 1147 households reported 52 cases of major repair and 159 cases of repainting as the result of air pollution in the period of 1964 and 1972; 112 cases of roof, wall, and drainage pipe repairs (changes) were confirmed as results of air pollution, and 8 cases of changes of iron staircases, and 128 cases of repainting of these staircases were confirmed as results of air pollution. According to the questionnaire and confirmation of facts, 21% of television antenna, 8.3% of windows, doors, and railings, 7% of washing machines, and 9% of bicycles were repurchased as a result of air pollution damages. Converted into monetary figures, these damages involved $1,060,000 of extra spending for the total of 235,000 households in the delta area. The laundry cost due to air pollution was estimated at $2,860,000 for the same area.

1973

42300 **APTIC NO. 64236**

Dorfman, Nancy S. and Arthur Snow

WHO BEARS THE COST OF POLLUTION CONTROL? THE IMPACT ON THE DISTRIBUTION OF INCOME OF FINANCING FEDERALLY REQUIRED POLLUTION CONTROL (FINAL REPORT). *Public Interest Economics Center, Washington, D. C., Council on Environmental Quality and Environmental Protection Agency, Contract EQC 310, 131p., Aug. 15, 1973. 28 refs.*

NTIS: PB-226447

An analysis of the distributional effects, by income category, of financing pollution abatement activities that have been mandated under Federal legislation encated through 1972 was made. The incremental air pollution control expenditures include estimates of expenditures required to implement the 1970 amendments to the Clean Air Act and the subsequent state implementation plans. The estimates include both the increased costs of using lower sulfur fuels and the capital, operating, and maintenance costs associated with pollution control devices. The estimates of total pollution control costs rise from $3.5 billion in 1972 to $25 billion by 1976 and $26.5 billion by 1980, amounting to 1.5% and 1.2% of the Gross National Product, respectively, the latter 2 years. This represents $335 per family unit in 1976 and $353 in 1980. By the end of the decade, they will cost families in the lower income brackets (corresponding to under $8000 in 1972) from $100-$200/yr and those in the top bracket (corresponding to over $50,000 in 1972) more than $1200. In 1972 pollution control costs are about equally divided among the three sectors: governments, private industry, automobiles, while in 1976, the major share will be financed by governments and in 1980 by private industry, though all three sectors will continue to make large contributions. (Author conclusions modified)

42301 **APTIC NO. 64012**

Lieberstein, H. Melvin

THE STEADY-STATE DEMAND-OUTPUT-WASTE ECONOMY. *Society of Engineering Science, Pollut. Eng. Sci. Solutions, Proc. Int. Meet. Soc. Eng. Sci., 1st, Tel Aviv, Israel, 1972, p. 487-503, 1973. 5 refs. (June 12-17.)*

A model is described for discussing economics and solutions needed to describe a steady-state. The equations relate the variables and operators involved to those solutions that should be proposed. Partial differential equations are given for outputs versus demands, equations are given relating wastes to recycling, and equations are presented of the steady-state using the mean-square asymptotic stability of outputs and waste. The model of the steady-state reduces to the Leontief model. The steady-state is also discussed when the structure is independent of the levels and locations of outputs. In the model of the global waste economy, the dependence of economic variables on space and time is included. If output values are to be used as dependent variables, they must include the costs of transportation to the points of consumption. Wastes must be treated as functions of outputs both at the point of production and along the route of transport, as well as at the point of consumption. The steady-stat economy may be studied as a dynamic system without reference to initial values, but certain properties of the economic structure must prevail for a steady-state to prevail. The steady-state economy will have some desirable features of stability, with respect to perturbations of outputs and wastes, which seem essential to the continued existence of any economy. There seems to be an irreducible level of waste residuals that can only be limited if outputs are limited. (Author summary modified)

42302 **APTIC NO. 63713**

Nakanishi, Hideo

INPUT-OUTPUT ANALYSIS TO AIR POLLUTION PROBLEMS. *Rep. Statist. Appl. Res., Union Jap. Sci. Eng., 20(3):29-36, 1973. 3 refs. (Also: Text in Japanese. Operations Res. Management Sci., 17(10), 1972.)*

An input-output analysis of economic and social factors relevent to analysis of air pollution problems is discussed. To analyze the economic repercussions of pollution control, nonmarket transactions are added to input-output tables dealing only with market transactions. The preliminary and empirical study of an air pollution model based on input-output techniques for the Coastal Kanto area of Japan is presented. An appendix is included describing the formulation of analyzing air pollution with an input-output approach.

42303 **APTIC NO. 64248**

Palmer, K.

NON-FERROUS SMELTERS SO2 ABATEMENT TO NEW ENVIRONMENTAL STANDARDS. *Institution of Chemical Engineers, London (England), Northwestern and Salford Univ. (England), Proc. Int. Conf. Control Gaseous Sulphur Compd. Emiss., Salford, England, 1973, 14p. 12 refs. (April 10-12.)*

The treatment of high grade sulfur dioxide streams directly for the production of elemental sulfur includes new pollution abatement regulations that apply to many smelters, and to certain classes of acid plants in particular. There is a trend to the use of newer smelter technologies, which insure that composite SO2 streams in the range of 7-8% will be produced. These strengths are ideal for economic acid produciton, with good SO2/sulfur trioxide conversions. The produciton costs of such acid to previously acceptable SO2 standards for the tail gases are presented. These are followed by an assessment of the cost increase which will probably be incurred in complying with the new environmental standards required. Estimated costs of non-ferrous SO2 recovery as elemental sulfur by concentration and new direct reduction processes are also considered. These are compared with acid production costs for approximately similar conversion efficiencies in ranges meeting the new antipollution legislation. (Author abstract)

42304 **APTIC NO. 65876**

Pearce, D. W.

ECONOMIC AND ECOLOGICAL APPROACHES TO THE OPTIMAL LEVEL OF POLLUTION. *Preprint, Southampton Univ., 24p., Feb. 1973. 19 refs.*

NTIS: N74-17331

The optimal level of pollution consists of a balanced amount based on economic and ecological considerations. Since the costs of pollution control increase as the desired air quality purity increases, a level of air purity is reached, above which the costs would be too high. These economic and ecological considerations are discussed and graphed. The case of zero pollution, growth and optimal externality, and an ecological approach to the optimal level of pollution are discussed. The conclusion of the analysis is that: if instability is functionally related to low survival probabilities, the pursuit of economic optima is at the expense of increased probabilities of nonsurvival.

42305 **APTIC NO. 63458**

Ruane, Michael Frederick

COST EVALUATION OF AIR POLLUTION CONTROL STANDARDS (FINAL REPORT). *Massachusetts Institute of Technology, Cambridge, Mass., Energy Laboratory, National Science Foundation Grant GI-32874, Proj. DSR 73996, Rept. MIT-EL 73-012, 169p., Feb. 1973. 38 refs.*

NTIS: PB 223 980

A model was developed to describe the sulfur dioxide and particulate air pollution characteristics of a fossil fueled steam electric power plant. The model contains three stages. The first considers boiler emissions and the application of one of four parameterized abatement methods: wet limestone scrubbing, catalytic oxidation, magnesium oxide scrubbing, and the use of tall stacks. The second stage tests stack emissions and uses meteorological dispersion models, particularly a double Gaussian model, to determine and test 3 hr, 24 hr, and annual worst case ground level concentrations. The third stage calculates the performance of the abatement method used in terms of economics and resource costs. The model can determine feasible combinations of plant types, site types, and abatement methods as support for a separate generation expansion model. It can also study environmental and economic sensitivities to changes in air pollution standards. General descriptions of the operation of the abatement methods and explanations of meteorological modeling are included as well as examples of the use of the model and a computer listing of the model. (Author abstract modified)

42306 **APTIC NO. 64132**

Argonne National Lab., Argonne, Ill.

SOCIAL COSTS FOR ALTERNATE MEANS OF ELECTRICAL POWER GENERATION FOR 1980 and 1900. REFERENCE REPORT. CHAPTER I. INTRODUCTION. *Atomic Energy Commission Contract W-31-109-Eng-38, 90p., March 1973. 50 refs.*

NTIS: ANL-8093(Vol. 1)

The risks, costs, and benefits of generating electrical energy are discussed. Discussion focuses on alternative base-load units of a nominal 1000 MWe output. The resource requirements of representative coal, oil, gas, and nuclear systems coming on stream in the years 1980 and 1990 are compared. Although the productive outputs from the alternative systems are nearly the same, their resource requirements are significantly different. Electrical energy historically has had a larger rate of growth than other energy forms. Presently about 1/4 of the nation s primary energy supply is used to produce electrical energy. With a continuation of the 6-7% annual growth in electricity consumption compared with about 3% for other energy forms, the use of primary energy for electricity production will eventually dominate the energy scene. In assessing the resource costs of the alternate energy systems, a broad spectrum of social cost categories were reviewed and examined including: the capital, fuel, operation, and maintenance costs of the alternate systems; the man-days lost due to occupational injury and fatality; somatic and genetic effects of radiation: occupational lung disease in uranium and coal miners; the health effects and property damage from airborne sulfur dioxide and particulate matter; toxic effects of trace metals; and despoliation costs; thermal discharge effects; and many others. Benefit-cost analysis is discussed.

1972

42307 **APTIC NO. 63596**

Anderson, Robert J., Jr. and Thomas D. Crocker

AIR POLLUTION AND PROPERTY VALUES: A REPLY. *Rev. Econ. Statist., 54(4):470-473, Nov. 1972. 14 refs.*

A reply is given to Professor Freeman s argument that relationships between air quality and land values can be determined only after a general equilibrium model including the spatial pattern of air quality as a parameter is constructed. This hypothesis is believed to be a misinterpretation of past work on property values, and his conclusions are believed to be wrong, both with respect to the usefulness of property value studies and with respect to research priorities. Statistical property value studies do not measure the gradient of property values with respect to air pollution. There does exist a general equilibrium model that, given property value bid equations, can, in principle, be used to generate equilibrium property values predicated upon alternative configurations of the environment. This model is discussed. Actual calculations using this model is difficult, but the model can be used to provide partial measurement of individual willingness to pay to avoid varying degrees of environmental pollution. Similarities among results of several past property value studies are presented. Although the specifications differed in some respects, the studies all showed statistically significant negative relationships between air pollution and property values.

42308 **APTIC NO. 63636**

Crocker, Thomas D.

THE WILLINGNESS TO PAY FOR AIR POLLUTION CONTROL. *California Univ., Riverside, American Institute of Mechanical Engineers Conucil of Economics, Rept. 7, p. 45-54, 1972. 18 refs.*

The propostions that the change in willingness to pay for air quality improvements is inversely related to the magnitude of air pollution dosages and that land values are more senstive to air pollution than are the values of improvement upon land are theoretically and empirically discussed. The empirical support for an inverse relationship between air pollution and residential property values seems quite strong. The result of the study implying a declining marginal damage function is less comfortable than the inverse relation between pollution dosages and property values. The importance of the declining marginal damage function hypothesis is that it often means the first-order conditions for a maximum of air pollution control s net benefits will be fulfilled at lower pollution dosages than if marginal damages are increasing. Land values are more responsive than property values to air pollution; thus, the less the share of land in property values, the greater the responsiveness of land prices or rents to changes in air pollution dosages.

42309 **APTIC NO. 64153**

Stepinski, Wlodzimierz

THE ECONOMIC EFFECT OF ENRICHING POWER-PRODUCING COAL. *(Efekt ekonomiczny wzbogacania wegla energetycznego). Text in Polish. Przegl. Gorn., 28(3):104-110, 1972.*

A method of determining the maximum profit and the highest economic feasibility of coal exploitation depending upon the ash content in the enriched coal is presented. The price depends on the coal quality and mining expenses. Three kinds of coal processing plants are known: sorting plants, where bulk coal is enriched manually; plants in which coal bits and lumps are manually and mechanically enriched; and washers with initial classification and enriching of coal with a grain size of less than 250 mm. The more heat the coal generates and the bigger its grain size, the higher is its value to the user. Equations are presented for the calculation of the coal processing plant s profitability from enriching the coal. The price of the exploited coal should be directly proportional to the heating value of the given coal. The latter depends upon the sort of coal used. In the enrichment process, various coal concentrates with different ash content can be obtained. Less coal is produced with a low ash content, but the unit price per coal concentrate is higher. The price obtained for the enriched coal is higher. Production of an average product is economically feasible. Sorting or washing coal are methods to be used depending on the profitability of processing enriched coal. The final overall benefits of the mining company and mining industry have to be considered.

42310 **APTIC NO. 64197**

Little (Arthur D.), Inc., Cambridge, Mass.

ECONOMIC IMPACT STUDY OF THE POLLUTION ABATEMENT EQUIPMENT INDUSTRY. *Environmental Protection Agency Contract 68-01-0553, Rept. EPA 230/9-73-030, 189p., Oct. 1972. 24 refs.*

NTIS: PB-225841

The economic impact of environmental standards on the industries providing air and water pollution abatement equipment to be required by both industry and government was analyzed. The aggregate expenditures needed to control air pollution control from stationary sources are $12.8 billion. Environmental legislation has already had a major positive impact upon the air pollution control business. The major uncertainly about future demand centers around the availability of proven technology to control sulfur oxide emissions. The analysis of impact, accordingly is made under two assumptions: present technology and practice and adequate proven technology in time for 1975-1977 application. Assuming less than adequate technology, the on-time enforcement (II) of particulate standards and (where possible) enforcement of gaseous emissions controls is projected to unilaterally increase the average costs of equipment over the 1972-1980 period by 10.3% for particulate control and 11.9% for gaseous control. Under the expected compliance schedule (III), this cost push inflation is estimated at 2.9% for particulate and 6.7% for gaseous. Under the assumption of adequate technology, on-time envorcement (II) would result in a 3.9% inflation of particulate costs and 15.9% for gaseous. Similarly, under the expected compliance schedule (III), the inflation for separate particulate control is 1.7% and that for gaseous control is 13.5%. (Author abstract modified)

1962

42311 **APTIC NO. 63909**

Tomaides, M.

OPERATION ECONOMICS OF AIR FILTERS. *Czechoslovak Academy of Sciences, Aerosols, Phys. Chem. Appl., Proc. Nat. Conf., 1st, Liblice, Czechoslovakia, 1962, p. 636-680. 2 refs. (Oct. 8-13.)*

An analysis of the economic parameters which influence the operation of air filters is presented. By a consistent division of the total filtering costs into partial costs, the most economically advantageous face velocities of the filtered air and optimum dust loading of filter media can be determined. A brief outline of possibilities for comparing the different types of filters enables the choice of an appropriate filter with regard to cost and performance. Cost of installation, initial cost of filtering equipment without filter cells, initial cost of filter cells, cost of operation, cost of electric power, cost of cleaning of renewable filter cells, cost of changing filter media of filter cells, and cost of replaceable filter cells are discussed.

STANDARDS AND CRITERIA

1974

42312 **APTIC NO. 63658**

Huber, H. and W. Rose

LIMITATION OF EMISSIONS FROM PULP DRYING PLANTS IN THE SUGAR INDUSTRY. DISCUSSION OF THE VDI GUIDELINE DRAFT 2594. *(Auswurfbegrenzung fuer Schnitzeltrocknungsanlagen der Zuckerindustrie). Text in German. Zucker, 27(5):253-258, 1974.*

For pulp drying plants of the sugar industry the past regulations concerning limitation of dust emission pertaining to plants whose dry waste gas quantity exceeds 100,000 cu m/hr limit the dust emission to 150 mg/cu m dry waste gas. In view of the planned reduction of the maximum allowable dust emission, the sugar industry called on the authorities to work out a separate VDI-guideline (Verein Deutsche Ingenieur) for the dust emissions from pulp drying plants because of the special conditions prevailing there. After close investigations a draft of a new guideline came out recommending an elimination of the dust concentration to a residual 100 mg/cu m wet waste for drying processes without molasses, and 150 mg/cu m wet waste gas with molasses, provided that water vapor does not condense at 0 C and 1013 mbar. For reduction of the sulfur dioxide emissions, a minimum stack height of 1.7 times the height of all surrounding buildings is recommended even with the use of sulfur- free fuels.

42313 **APTIC NO. 63887**

Ishiguro, Tatsukichi and Toshio Odaira

CONTROL MEASURES FOR FIXED EMISSION SOURCES. *(Kotei hasseigen taisaku). Text in Japanese. In: Studies on Tokyo Smog. Tokyo Metropolitan Research Inst. for Environmental Protection (Japan), Rept. 3, p. 105-109, March 1974. 7 refs.*

The nitrogen oxides emission standards for various types of boilers and furnaces are presented. For facilities started after August 10, 1973, the standards will be applicable at completion, and for those constructions started prior to that date or already completed, the standards will be applicable as of July 1, 1975. For nitric acid manufacturing facilities, the standard will be applicable as of July 1, 1976. The NOx emission standards for newly constructed gas burning boilers of the 40,000 N cu m/hr capacity will be 130 ppm, for boilers using coal and other solid fuels, 480 ppm, for boilers burning crude oil tar and other types of fuel, 180 ppm, for metal heating furnaces of 10,000 N cu m/hr, 200 ppm, for petroleum heating furnaces, 170 ppm, and for nitirc acid manufacturing facilities, 200 ppm. These emission standards are more stringent than those applied in the United States. The denitration methods for stack gases are compared. The wet methods must solve the problems of absorption mechanism, absorbent selection, absorbent treatment, reuse of by-products, and the running cost. The dry methods require catalysts that are resistant to sulfur dioxide, oxygen, water, and heavy metals, some appropriate pretreatment system engineering, and lower initial costs. The hydrocarbon emission standards were set for the total emission concentration from fixed sources emitting 15 types of organic solvent vapors including methanol. The standard of 200 ppm is applicable as of March 1974, and when singly emitted, 50 ppm is set for benzene and 100 ppm for other HCs.

42314 **APTIC NO. 66057**

Quarles, John

CONTROL OF AIR POLLUTION FROM NEW MOTOR VEHICLES AND NEW MOTOR VEHICLE ENGINES. LOW EMISSION VEHICLES. *Federal Register, 39(176):32612-32614, Sept. 10, 1974.*

Revisions of regulations regarding the control of air pollution from new motor vehicles and new motor vehicle engines are presented. The Federal Government will pay premium prices for motor vehicles classified as low emission vehicles with performance better than required by the Federal standards in effect at the time of their procurements. Regulations have been revised to specify that any light duty vehicle which meets the current standard of 0.4 g/mi nitrogen oxides before such a standard becomes effective under section 202 will, subject to the other requirements in effect under section 212, qualify as a low emission vehicle. Standards for hydrocarbons and carbon monoxide remain the same to qualify as a low emission vehicle. Heavy duty vehicle regulations for low emission vehicles have been withdrawn from the notice of proposed rulemaking until a heavy duty emissions test procedure is developed which will more accurately represent emissions from heavy duty vehicles than the current test procedure.

42315 **APTIC NO. 66072**

Quarles, John

APPROVAL AND PROMULGATION OF IMPLEMENTATION PLANS. MAINTENANCE OF NATIONAL AMBIENT AIR QUALITY STANDARDS. *Federal Register, 39(156):28906-28910, Aug. 12, 1974.*

The proposed list of air quality maintenance areas which have the potential for violation of national ambient air quality standards within 10 years for the states of Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin are listed. The state air quality maintenance area (AQMA) designations submitted by Wisconsin are proposed to be approved by the Environmental Protection Agency, and other AQMAs are to be disapproved because of procedural deficiencies. Public comments are solicited.

42316 **APTIC NO. 66074**

Quarles, John

SUPERSONIC AIRCRAFT. CONTROL OF AIR POLLUTION. *Federal Register, 39(141):26653-26655, July 22, 1974.*

The Clean Air Act requires the establishment of emission standards for different classes of aircraft engines which emit pollution. Standards are presented and discussed for gas turbine engines in supersonic aircraft based on the best available combustor design technology expected in 1979 and later with due consideration for the inherently higher emission characteristics of supersonic aircraft engines under landing/takeoff cycle conditions. The standards are for newly manufactured engines used in supersonic aircraft in Jan. 1, 1979 and for newly certified engines used in supersonic aircraft in Jan. 1, 1981. The feasibility of various supersonic aircraft controls, the effect of supersonic emission reductions on air quality at the John F. Kennedy Airport, and the cost of achieving standards are discussed. Comments are solicited. The standards for exhaust emissions of hydrocarbons, carbon monoxide, oxides of nitrogen, and smoke and for test procedures for engine exhaust gaseous emissions are given.

42317 **APTIC NO. 66068**

Ravan, Jack E.

ALABAMA. APPROVAL AND PROMULGATION OF IMPLEMENTATION PLANS; PROPOSED PLAN REVISION. *Federal Register, 39(144):27148-27149, July 25, 1974.*

The revision of Alabama s implementation plan to meet air quality standards was approved by the Environmental Protection Agency. Section 4.10.2, Emission Limits, is revised to 15 lbs. of solid particulate and 22 lbs of total particulate emission limits for each ton of aluminum produced by the reduction process. Because of differences in the processing techniques used by the two existing aluminum smelters in the state, only one must meet the 15-pound limit. Copies of information submitted by Alabama to support the proposed plan revision are available from EPA. Comments on the revision are solicited.

42318 **APTIC NO. 66059**

Ravan, Jack E.

FLORIDA IMPLEMENTATION PLAN. PROPOSED REVISION. *Federal Register, 39(155):28646, Aug. 9, 1974.*

A proposed revision to the Florida state implementation plan is outlined, and comments are solicited. The proposal involves regulating the sources involved in the emission of pollutants by combustion of vegetative matter -- bark boilers, bagasse boilers, and other waste wood boilers -- by providing particulate emission limits to apply specifically to them. The new rule provides particulate limiting standards for sources with a heat input of 30.10 BTU/hr or more. For carbonaceous fuel burned by existing sources of this size, the limit is 0.3 lbs/10 to the 6th power BTU; in the case of new sources, the limit is 0.2 lbs/10 to the 6th BTU. The particulate limiting standard for the fossil fuel which the waste wood boilers burn is 0.1 lbs/10 to the 6th BTU. Limits on visible emissions from sources burning carbonaceous fuel are: for sources with an input less than 30.10 BTU/hr, visible emissions may not be of an opacity greater than 20%; for larger sources the limit is 30%. All sources are also permitted emissions of an opacity up to 40% during 2 min of any hour.

42319 **APTIC NO. 66056**

Train, Russell E.

CONTROL OF AIR POLLUTION FROM NEW MOTOR VEHICLES AND NEW MOTOR VEHICLE ENGINES. *Federal Register, 39(176):32609-32612, Sept. 10, 1974.*

Comments were made on proposed regulations with regard to exclusion and exemption of motor vehicles and motor vehicle engines which resulted in modifications of the regulations. The modifications and the reasons for them are described. Comments were received which requested that the Environmental Protection Agency adopt lists of the specific vehicles excluded by the regulations. Recommendations were also received to exclude vehicles of limited production intended for show or hobby use such as dune buggies. A number of comments were received on the 20 mph average speed criterion. Additions were proposed to the exclusion section to exclude firetrucks, vehicles which do not require state licenses, road construction vehicles, and vehicles of inordinate size. A suggestion was made to change the definition of motor vehicles. Other comments were made regarding the authority of EPA to grant in-use exemptions, testing exemptions, fuel conversion exemptions, and other aspects. The changes made because of these comments are listed.

42320 **APTIC NO. 63886**

Utagawa, Mitsuru and Toshio Odaira

AUTOMOTIVE EMISSION GAS CONTROL MEASURES. *(Jidosha haishutsu gasu taisaku). Text in Japanese. In: Studies on Tokyo Smog. Tokyo Metropolitan Research Inst. for Environmental Protection (Japan), Rept. 3, p. 88-105, March 1974. 3 refs.*

The history of automotive exhaust gas control measures, the presently used standards for carbon monoxide, hydrocarbons, and nitrogen oxides based on the revision of December 12, 1972 are discussed. According to these regulations, the partial revision of environmental protection standards effective January 8, 1973 forced all active cars to install spark timing delay devices or catalytic reaction control devices in order to reduce HC and NOx emission to prevent the formation of photochemical smogs. Ordinances of the Environmental Agency further states that all automobiles produced after April 1975 (using gasoline or liquefied petroleum gas) will produce an average of less than 2.1 g/km of CO, less than 0.25 g/km of HC (excluding evaporation gas and blowby gas HCs), and less than 1.2 g/km of NOx. Automobiles produced after April 1, 1976 will further control the emission of NOx to less than 0.25 g/km. The maximum allowable emission standards will be established according to suitable methods based on the actual conditions in Japan.

42321 **APTIC NO. 63829**

TRENDS IN THE 1976 REGULATIONS ON AUTOMOTIVE EXHAUST EMISSIONS. *(Jidosha haigasu no 51 nen kisei o meguru ugoki). Text in Japanese. Sangyo to Kankyo (Ind. Environ.), 3(7):70-73, July 1974.*

The extremely severe 1976 regulations on automotive exhaust emission are criticized by foreign car manufacturers as import restrictions for foreign cars. The number of cars per unit habitable area in Japan is the highest in the world, and the car density is about 10 times that in the U. S. The realization of grave air pollution problems made the automobile industry and citizens support these severe regulations. According to the 1975 regulations, the carbon monoxide and hydrocarbon emissions are to be reduced to 1/10 of the present standard, and nitrogen oxides emission to 1.2 g/km for passenger cars which represents a 45% reduction. According to the 1976 regulatons, The NOx emission is to be reduced to 1/10 of the present standard, which is 0.25 g/km. The common feeling in the automobile industry is that compliance with the 1975 regulations is the limit with the present technology, and more time is needed for technological development to comply with the 1976 regulations.

42322 **APTIC NO. 63841**

CREATION OF LIVABLE HUMAN ENVIRONMENT. SPECIAL ISSUE ON AIR POLLUTION REGULATIONS. *(Sumiyoi ningen kankyo zukuri. Taiki kankei kogai kisei tokushu). Text in Japanese. Tsusansho Koho (Gaz. Minist. Int. Trade Ind.), no. 2, July 9, 1974.*

Revisions in the air pollution control law enforcement ordinance and enforcement regulation effective April 1, 1974 are described. The primary revision is the tightened sulfur oxides emission standards. The specified areas are increased from 70 to 99. The K value is reduced from 6.42 to 3.50 in major cities and 7.59 to 4.67 in some other areas. The special emission standard for new establishment is reduced from present 2.92, 3.50 and 5.2 to 1.17, 1.75 and 2.34, respectively. In the second article, the amendment concerning the total smoke emission quantity control is summarized. The criteria for total emission quantity and plans for smoke emission control are specified. Also, the summary of the proceeding of the pollution control committee meeting and environmental protection committee meeting in the Japanese House of Councilors is given. In the third article, the background on automotive exhaust emission and summaries of the present and 1975 automotive exhaust emission standards are described. The reduction rate of the 1975 standard compared to the present standard is given in tabular form. Regulations on permissible quantity of automotive exhaust emission are also summarized.

42323 **APTIC NO. 63849**

A FULL-SCALE CAMPAIGN FOR CLEANING THE SKY-ELIMINATION OF PHOTOCHEMICAL SMOGS BY 1977. *(Sora no kuriningu sakusen ni hongoshi-52-nen made ni kokagaku sumoggu no kaisho). Text in Japanese. PPM (Japan), 5(7):82-89, July 1974.*

The ten year plan between 1974 and 1983 for cleaning the environment announced this year is based on the most stringent standards in the world. The target standard for sulfur dioxide is less than 0.04 ppm daily average and a less than 0.1 ppm hourly average by 1975. For nitrogen oxides, the target is less than 0.02 ppm daily average for 80% of the year, to be reached by 1977, and less than 0.02 ppm daily average to be reached by 1980. For suspended particulates, a less than 0.10 mg/cu m daily average and a less than 0.02 mg/cu m hourly average must be reached by 1980; for carbon monoxide, a less than 10 ppm daily average and a less than 20 ppm eight hour average must be reached by 1975; for hydrocarbons, a less than 0.35 ppm average for three hours between 6-9 am must be attained by 1977; and for photochemical oxidants, a less than 0.15 ppm hourly average must be attained by 1977 and a less than 0.06 ppm hourly average must be attained by 1980. The lead concentration in the air must be less than 1.5 mg/cu m daily by 1975, and the level of odor must be such that most of local residents are normally unaware of it by 1975. For attaining these levels, maximum allowable emission standards and necessary reduction amount, instructions for various industries with regards to emission, desulfurization systems, heat and energy sources, and control equipment are discussed.

1973

42324 **APTIC NO. 64050**

Schuits, W. D. and J. J. Beauchamp

THE DEVELOPMENT OF AIR QUALITY INDICES (SUMMARY REPORT). *Oak Ridge National Lab., Oak Ridge, Tenn., National Science Foundation Interagency Agreement AEC 40-237-70, 67p., July 1973. 6 refs.*

NTIS: ORNL-NSF-EP-56

The development of four specific air quality indices is described. They are the Oak Ridge Air Quality Index, two statistically based indices-APINDEX and APINDEX-2, and a dual purpose indexing system suitable for both short-term and long-term usage. Rationales, characteristics, evaluative data, and computer codes are given for each of the indexing concepts. Air quality indexing research needs to consider: types and availability of data, appropriateness and availability of standards, scaling and weighting techniques, compositing procedures, and ways and means for communicating index values. All systems assumed for conceptualization purposes that five air pollutants specified by the Environmental Protection Agency were the inputs: sulfur dioxide, carbon monoxide, nitrogen oxides, total oxidants, and total particulate matter. For each pollutant there are one or more primary standards and one or more secondary standards are promulgated the EPA. National standards were used when appropriate, and adjusted values where necessary. Satisfactory air quality indices are possible and a logical indexing system that is based on federally specified standard values and that utilizes a decision-making rationale is superior for short-term indexing applications.

42325 **APTIC NO. 63527**

Rossnagel and Associates, Cherry Hill, N. J.

QUICK REFERENCE GUIDE TO...AIR POLLUTION CODES. *Chem. Eng. Deskbook, 80(12):11-12, 14, 16, 18, 20, 22, June 18, 1973.*

A condensed and up-to-date reference of key emission codes is compiled covering code requirements for incinerators, particulates, organics, sulfur oxides, nitrogen oxides, odor, and special items in the five areas of New England, Northeastern States, Capital area, Southeastern States, and Midwestern States. Federal Environmental Protection Agency limits are included for comparison. The air pollution codes for each area of interest are listed by each state within the broader area.

42326 **APTIC NO. 65891**

Committee on Public Works, Subcommittee on Air and Water Pollution

THE IMPACT OF AUTO EMISSION STANDARDS. *93rd Congress (Senate), 1st Session, Serial 93-11, 157p., Oct. 1973. 74 refs.*

GPO

The impact of the automobile emission standards for carbon monoxide, hydrocarbons, and nitrogen oxides was determined and is discussed. The Environmental Protection Agency certification test was studied and found not to be indicative of performance of emission control systems in customer use, but it is the only method available to assure consumers that their cars will approach emission control requirements. The warranty requirements in the law cannot be effectively enforced. Air quality standards were reviewed and found to be valid. The emission controls chosen by automobile manufacturers generally reduce fuel economy. Diesel, rotary, and stratified charge engines will be able to meet HC and CO standards without add-on devices; the spark piston engine with a catalyst will also meet the standards, but the impact of the catalyst with regard to presently unregulated emissions is uncertain. The leadtime given in enforcing the Clean Air Act was examined and found to be sufficient. Difficulties with the NOx measurement method were studied. The control of fuel additives was also studied; regulations controlling these additives have not yet been promulgated by the EPA. The effects of air pollution on health are reviewed.

1972

42327 **APTIC NO. 64196**

Ellsaesser, Hugh W.

HISTORICAL DEVELOPMENT OF OUR AIR QUALITY STANDARDS OR HOW TO GUARANTEE FAILURE. *Preprint, California Univ., Livermore, Lawrence Livermore Labs., 21p., 1972. 9 refs. (Presented at the Environmental Sciences Seminar, Livermore, Calif., July 25, 1972.)*

Current and proposed air quality standards are critized and the health hazard effects of air pollutants are questioned. The presumption in 1967 that air pollution is injurious to health was widely prevalent and action was initiated to develop data to support the presumption. The extent to which it succeeded is apparent now in the National Clean Air Act and in the very strict state and national air quality standards which are purportedly based on health effects. The definition of health effects has been expanded to include any detectable physiological response such as odor, eye irritation, carboxyhemoglobin level, enzyme level or interference with function such as increased respiratory resistance. When reports on health effects are critically analyzed and compared, they almost invariably evoke inconsistencies, contradictions and instances of irreproducibility which cast double on the entire body of evidence. The Federal air quality standards are based on data which are not supported and which are too strict. Variations in natural background make the proposed primary standard or nationwide standard unrealistic and unattainable regardless of the time allowed for compliance.

LEGAL AND ADMINISTRATIVE

1974

42328 **APTIC NO. 63978**

Anko, Takumi

ENVIRONMENTAL MANAGEMENT PLANS. *(Kankyo kanri keikaku ni tsuite). Text in Japanese. Kankyo Gijutsu (Environ. Conserv. Eng.), 3(6):403-408, June 1974.*

Regulation of air pollution, air and water management plans, the legislative guidelines for environmental management, environmental management zoning, environmental capacity and the total emission standard, subject industries and emission quantity allocations, and special notes in the total emission regulation bill are discussed. The allocation of standard emission quantity for each place of operation is a problem. The purpose of the total emission regulation is not monitoring of all small scale family operations, but regulating the total emission of a given district. To achieve this, large factories which have the economic and technical resources for controlling their total emission are the main subjects, and the total emission of these factories is to be controlled to under 80% of the total emission allocation for that particular district. Then, each of these large factories is given an individual emission allowance, and is requested to adhere to that standard. In the air management district of Kobe, factorie with more than 10,000 N cu m/hr emission are designated as subject to the regulation, and each is given an emission allowance. The total emission from these 40 factories comprises 85% of the total emission allocation for the Kobe area. Each individual allowance is generally determined by the amount of pollutant emission. The cost of pollution control per unit is lower for larger scale factories. Therefore, the larger the factory, the more stringent is the regulation.

42329 **APTIC NO. 63728**

DeFalco, Paul, Jr.

CALIFORNIA STATE IMPLEMENTATION PLAN. NOTICE OF ACKNOWLEDGEMENT. *Federal Register, 39(124):23089-23090, June 26, 1974.*

Acknowledgement is made of Revision 4 of the State of California Implementation Plan for attaining and maintaining national air quality standards. The plan contains a revised mobile source retrofit strategy whereby nitrogen oxide retrofits for 1966-1970 light duty vehicles will be required starting October 1, 1973 in certain critical areas and by April 1, 1974 statewide. Vehicle inspection and maintainence will begin as a piliot program in selected counties in 1974. Subsequent to December 31, 1975, inspection will be required in the South Coast Air Basin. Various newly enacted laws to comply with Environmental Protection Agency legal authority requirements are outlined. Preliminary review of Revision 4 indicates that portions of the revised plan may be approvable; deficiencies, however, are apparent. The primary problem with the revised pollutant control strategy applying to the Metropolitan Los Angeles Intrastate Air Quality Control Region is the lack of sufficient transportation controls and failure to demonstrate that all reasonable measures are being taken as expeditiously as possible to obtain better air quality in this region.

42330 **APTIC NO. 63666**

Feldstein, Milton

A CRITICAL REVIEW OF REGULATIONS FOR THE CONTROL OF HYDROCARBON EMISSIONS FROM STATIONARY SOURCES. *J. Air Pollution Control Assoc., 24(5):469-478, May 1974. 27 refs.*

A critical review of regulations for the control of hydrocarbon emissions from stationary sources is presented. The major purpose of controlling the emission of organic compounds from either stationary or mobile sources is to reduce the effects of photochemical smog. A survey of approximately 30 air pollution control agencies indicates that most agencies which control organic compound emissions have adopted the Los Angeles Rule 66 approach to solvent control. The approach taken by this rule to reduce photochemically reactive emissions is described in detail. Rule 66 limits the emission or organic materials from any equipment in which organic solvent or material containing any organic solvent is used to no more than 15 lb in any one day when baking, heat-curing, heat-polymerizing, or flame contact is involved. The San Francisco Bay area varies from the Rule 66 approach and uses Regulation 3. Its major control aspect concerns the use of complying solvents, complying surface coatings, and complying industrial surface coatings. It limits the emission or organic compounds to less than 50 ppm, as measured with a combustible gas indicator. Meeting the goal of the Federal Oxidant Standard is intimately tied in with the larger problem of mobile source organic emission control. A satisfactory resolution of the problem will come only when the dynamics of atmospheric oxidant formation are more fully understood. It must be assumed that the control of reactive organic compounds to the extent that they participate in these reactions is directionally correct.

42331 **APTIC NO. 65809**

Gushee, David E.

PLANT SITING AND POLLUTION CONTROL. *Chem. Technol., 4(8):468-470, Aug. 1974. 5 refs.*

Three recent environment laws that either directly or indirectly affect chemical plant siting decisions are reviewed. They are the National Environmental Policy Act of 1969 (NEPA), the Clean Air Act Admendments of 1970, and the Federal Water Pollution Control Act Amendments of 1972. None of these laws were passed primarily as land use measures, yet all take note of the growing realization that the way land is used determined the nature and extent of environmental quality problems. Their handling of the converse recognition that long-term management of environmental quality will require management of land use patterns is discussed. New chemical plants must be reviewed with respect to new source performance standards and the land use factors required by these laws. Those located in States with NEPA-type laws will need environmental impact statements. If the proposed plant site is in an air quality control region with automobile pollutant problems, the plant must be approved by air quality officials reviewing it as an indirect source.

42332 **APTIC NO. 63885**

Kyoda, Mitsue, Saburo Fukuoka, and Toshio Odaira

PHOTOCHEMICAL SMOG EMERGENCY MEASURES IN TOKYO. *(Tokyoto no kokagaku sumoggu kinkyuji taisaku). Text in Japanese. In: Studies on Tokyo Smog. Tokyo Metropolitan Research Inst. for Environmental Protection (Japan), Rept. 3, p. 66-87, March 1974.*

In Tokyo, a high oxidant warning is issued when the hourly measurement of oxidant reaches 0.15 ppm, and an alert is issued when the level reaches 0.3 ppm. With the alert, citizens are requested to refrain from unnecessary driving, and the operators of fixed emission sources are requested to reduce emission of sulfur oxides. Oxidants are now monitored at 20 locations, which are connected with digital telemeters to the air pollution control center. Smog alert districts are divided into three segments: the center, eastern, and western areas. The countermeasures are divided into four steps: prediction, warning, alert, and heavy alert. Large scale fixed emission sources are requested to reduce their fuel consumption by 20% with a warning, and by 40% with an alert. For mobile emission sources (automobiles), the compliance to both warning and alert is on an individual voluntary basis, but with the issuing of heavy alert, the governor requests road and traffic control measures on local basis. The large scale emission sources cooperating at the time of emergency include 252 factories and plants in Tokyo. The total emissions from these installations constitute 85% of the entire emission in Tokyo during non-heating seasons. By the cooperation of these places of operations, the total emission gas is expected to be reduced by 17% during warnings and by 2% during alerts.

42333 **APTIC NO. 63983**

Loeblich, H.-J.

THE ENVIRONMENTAL PROTECTION ORGANIZATION OF A MINERAL OIL COMPANY AND THE ASSIGNED IMMISSION PROTECTION AGENT. *(Die Umweltschutzorganisation einer Mineraloelgesellschaft und der Betriebsbeauftragte fuer Immissionsschut). Text in German. Erdoel Kohle-Erdgas-Petrochem., 27(5):280-282, May 1974.*

The large mineral oil companies in West Germany have their own environmental protection organizations within the individual companies. They are mostly staffed with experts in the fields. Beginning with April 1, 1974 the Federal Immission Protection Act calls for the appointment of an emission protection agent by these companies and all other industrial polluters who will be given power to promote development and introduction of non-polluting processes and who will see to it that all operations comply with the new Act. He has to furnish an annual report on planned and completed measures. The companies have to notify the authorities of the assignment of such an agent. As an example, it is shown how in one mineral oil company the new legal regulations are met within the framework of the already existing company-operated environmental protection organizations. A department concerned with all questions on environmental protection has existed for years, with part of the public affairs department reporting directly to the board of directors. The head of this department was named to assume the tasks of an emission protection agent.

42334 **APTIC NO. 66061**

McGlennon, John A.

RHODE ISLAND. PROPOSED REVISION TO IMPLEMENTATION PLAN. *Federal Register, 39(148):27701, July 31, 1974.*

A proposed revision to Regulation 8 limiting the sulfur content in fuels to be used, sold, or delivered in the State of Rhode Island is described. Comments may be submitted on this proposed revision to the Rhode Island implementation plan.

42335 **APTIC NO. 66048**

McGlennon, John A. S.

NEW HAMPSHIRE. PROPOSED REVISION TO IMPLEMENTATION PLAN. *Federal Register, 39(163):30167, Aug. 21, 1974.*

A proposed revision to the New Hampshire implementation plan is presented involving regulation changes to ensure the conformance of various sources with the Federal ambient air quality standards for sulfur dioxide and with Federal New Source Performance Standards. Comments are solicited.

42336 **APTIC NO. 65884**

Moeller, Dade W.

THE CRISIS IN AIR POLLUTION MANPOWER DEVELOPMENT. *Preprint, Air Pollution Control Assoc., 21p., 1974. (Presented at the Air Pollution Control Association, Annual Meeting, 67th, Denver, Colo., June 12, 1974, Paper 74-29.)*

A series of three studies conducted by the National Air Pollution Manpower Development Advisory Committee led to the conclusion that there is a crisis in air pollution manpower development in the U. S. today. These studies, designed to define the essential components of a total manpower development program and to evaluate current efforts on specific segments of such a programs, showed that the existing Federal manpower program fails to address many of the problem areas that need attention, that greater effort needs to be directed to meeting the air pollution educational requirements of State highway departments and planning agencies, and that the quality of most graduate level university programs in air pollution control is on the decline because of the withdrawal of Federal financial support. The withdrawal of training grant funds has had averse affects on on-going environmental research, on faculty, and on students. (Author abstract modified)

42337 **APTIC NO. 64407**

Nakamitsu, Sukenao

AN OUTLOOK OF THE NATIONAL INSTITUTE FOR ENVIRONMENTAL POLLUTION RESEARCH. *(Kokuritsu kogai kenkyusho ni tsuite). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 10(6):573-577, June 1974.*

The National Institute for Environmental Pollution was established as of March 15, 1974 for the purposes of conducting studies on the effects of air and water pollution and noise on human health and the environment, for research on monitoring and measurement methods of air and water pollution and noise, experimental studies and investigations on methods of prevention of all types of public nuisance, and collection, processing and supply of data on pollution from domestic and foreign sources. The research system comprises surveying of environmental news and selection of research subject matter, which is in turn divided into departmental research and special project team work. The research members are supplied by the pools in the environmental information and technology department, plus floating (freelance) research members. The results are obtained and fed back for selection of the next research project. The organization is as follows: director and deputy director, general analytical department, measurement technology department, environmental phenomena department, environmental health department, biological environment department, environmental information department, and technology department. Apart from these, there is the planning section, which is directly headed by the director and deputy director of the institute. The total cost for the installation is approximately $20,600,000.

42338 **APTIC NO. 66050**

O Connell, R. L.

NEVADA: APPROVAL OF COMPLIANCE SCHEDULES. APPROVAL AND PROMULGATION OF IMPLEMENTATION PLANS. *Federal Register, 39(186):34303-34304, Sept. 24, 1974.*

Approval is given for revisions of the compliance schedules of the Nevada state implementation plan. The schedules list the final date on which compliance with emission regulations must be made to meet ambient air quality standards.

42339 **APTIC NO. 63715**

Pechan, Edward H., Ellison S. Burton, and William Sanjour

COMPUTERIZED REGIONAL AIR POLLUTION ABATEMENT AND FUELS USE MODELING. *Comput. Oper. Res., 1(1):39-47, 1974. 3 refs.*

The relationships between source emissions, meteorological conditions, and the air quality which results are very complex. The concentrations of pollutants in the atmosphere are controlled by variables of time, space, and various chemical and photochemical reactions. Knowlege of these relationships is quite important since air pollutant standards under the Clean Air Act refer to pollutant concentrations in the ambinet air. The states are responsible for developing their own State Implementation Plans (SIPs) for meeting the standards in each of the Air Quality Control Regions (AQCRs) in the state. The thrust of an SIP is the control of concentrations through the control of emissions. Application of a least cost modeling approach to the development or modification of SIPs may permit meeting of standards at a savings of capital expenditures, operating and maintenance costs and scarce clean fuels. A series of computer models to support such analysis is introduced, and the application of the model to a sample air quality control region is discussed. (Author abstract)

42340 **APTIC NO. 65877**

Purdom, P. W.

CHANGING CONCEPTS IN GRADUATE ENVIRONMENTAL EDUCATION. *Preprint, Air Pollution Control Assoc., 18p., 1974. (Presented at the Air Pollution Control Association, Annual Meeting, 67th, Denver, Colo., June 12, 1974.)*

Some of the pertinent background, scope, and purpose of environmental education are reviewed. The specialized graduate education in the field of air pollution is discussed. The history or air pollution, organizations to study pollution, conferences about pollution, and task forces on pollution are reviewed. The scope of environmental education, and the training necessary to deal with environmental problems are discussed. A suggested air quality engineering curriculum is given which would give 25% emphasis to engineering, 10% emphasis each to chemistry, biology, physics, meteorology, applied mathematics, and environmental health, and 15% to social sciences. The university administration of environmental programs is mentioned. The undergraduate/graduate sequence should be composed of: a broad-based undergraduate degree program as general prepration for an environmental career; and a graduate program to provide an in-depth experience in a special area, such as air pollution control.

42341 **APTIC NO. 63740**

Quarles, John

AIR PROGRAMS APPROVAL AND PROMULGATION OF IMPLEMENTATION PLANS. *Federal Register, 39(132):25291-25301, July 9, 1974.*

Several amendments of a clarifying, procedural nature affecting the indirect source review regulation (40 CFR 52.22 (b)) that was incorporated into the Clean Air Act Implementation plans for a total of 52 states and territories are presented. Explanations are provided for the need for the regulation, purpose, and effect of indirect source, review, the need to examine the air impact quality of an indirect source further than one-fourth mile from the source, and frequently-raised questions of basic interpretation Changes to the regulation concern phased development, the basis for disapproval for violations of the carbon monoxide standard, the basis for decisions involving photochemical oxidant and nitrogen dioxide, use of traffic flow characteristics for highway decisions, permit conditions and penalties, extension of time for commencement of on-site construction after receipt of approval from 18 to 24 months, change in data to be submitted by the applicant, examples of traffic flow characteristics, necessity for the phase on-site to be added to the definitions to commence construction and to commence modification, sources subject to Management of Parking Supply Regulations, and the basis for decisions on carbon monoxide impact. Analytical techniques for determining carbon monoxide concentrations are presented, along with administrative procedures and delegation.

42342 **APTIC NO. 66046**

Quarles, John

APPROVAL AND PROMULGATION OF IMPLEMENTATION PLANS. APPROVAL OF COMPLIANCE SCHEDULES; ALABAMA. *Federal Register, 39(191): 35335-35343, Oct. 1, 1974.*

Approved compliance schedule revisions are listed for the Alabama state implementation plan. Each establishes the date by which an individual air pollution source must attain compliance with the emission limits of the state implementation plan. This date is indicated as the final compliance date.

42343 **APTIC NO. 66051**

Quarles, John

APPROVAL AND PROMULGATION OF IMPLEMENTATION PLANS. REVISIONS TO NEW YORK STATE IMPLEMENTATION PLANS. *Federal Register, 39(181):33313-33314, Sept. 17, 1974.*

Approval is given to a revised section of the New York state implementation plan. The revision changes the compliance date for a regulation on photochemically reactive solvents from certain processes in the New York metropolitan area. Therefore, the EPA disapproval of Part 205 of Title 6 of the New York Official Compilation of Codes, Rules, and Regulations is revoked.

42344 **APTIC NO. 66052**

Quarles, John

RHODE ISLAND. PROPOSED REVISIONS TO IMPLEMENTATION PLAN. *Federal Register, 39(102):18298-18299, May 24, 1974.*

Proposed revisions to the Rhode Island state implementation plan are described, and comments are solicited. The revisions are directed toward locating monitoring sites in areas of maximum pollutant concentration. During plan development, sites were chosen based on predicted results from diffusion modeling and limited air quality. Continuous air quality data collected during 1972 and 1973 showed that these predictions were not valid in all cases. Therefore the revisions were made to provide a more accurate presentation of air quality data and to update and calibrate the air quality display model. Modifications were also made in the levels of sulfur dioxide which signal an alert and a warning level.

42345 **APTIC NO. 66053**

Quarles, John

COLORADO. PROPOSED SULFUR OXIDES IMPLEMENTATION PLAN. *Federal Register, 39(102):18297, May 24, 1974.*

A proposed revision of the Colorado state implementation plan is described, and comments are solicited. The revision would delete the sulfur oxide emission control regulation because the national secondary standard for sulfur oxide is not approached in any areas of the state, therefore the regulation is not needed.

42346 **APTIC NO. 66060**

Quarles, John

APPROVAL AND PROMULGATION OF IMPLEMENTATION PLANS. ENFORCEMENT POLICIES. *Federal Register, 39(182):33512, Sept. 18, 1974.*

Amendments are promulgated and approved to clarify the Environmental Protection Agency s enforcement policies with regard to the state implementation plans.

42347 **APTIC NO. 66069**

Quarles, John

PENNSYLVANIA. AIR QUALITY COMPLIANCE SCHEDULES. *Federal Register, 39(141):26652-26653, July 22, 1974.*

Revised compliance schedules for Pennsylvania s state implementation plan are presented listing the source, location, regulation involved, date of adoption, effective data, and final compliance date. Comments on the revisions are solicited.

42348 **APTIC NO. 66071**

Quarles, John

KANSAS, APPROVAL OF COMPLIANCE SCHEDULES. *Federal Register, 39(133):25319-25320, July 10, 1974.*

Approval is given for revised compliance schedules for the Kansas state implementation plan. Each approved revision establishes a new date by which the individual source must comply with the applicable emission limitation in the Federally approved state implementation plan. This data is indicated under the heading, final compliance date.

42349 **APTIC NO. 66073**

Quarles, John

EXEMPTIONS: REVIEW OF NEW SOURCES AND MODIFICATIONS; ARIZONA, CALIFORNIA, AND NEVADA. *Federal Register, 39(152):28284-28285, Aug. 6, 1974.*

Regulations to correct oversights in the Federally promulgated portions of certain state implementation plans were promulgated, reviewed through public notice, hearings, and other comments, and approved or denied approval. The revised regulations correct deficiencies in the state implementation plans submitted by Nevada, Arizona, and California. The regulations give legally enforceable procedures that will enable the states to prevent construction of new sources and modifications of existing sources in such construction will result in the violation of the applicable portion of the state's control strategy or will interfere with the attainment or maintenance of national ambient air quality standards.

42350 **APTIC NO. 66054**

Ravan, Jack E.

ALABAMA IMPLEMENTATION PLAN. PROPOSED REVISION. *Federal Register, 39(155):28645-28646, Aug. 9, 1974.*

A proposed revision to the approved Alabama state implementation plan with regard to particulate control of emissions from coke ovens is presented. The new coke oven regulations should be more enforceable and restrictive than current regulations, and therefore would not prevent or interfere with the attainment and maintenance of the national ambient air quality standards if approved. Comments are solicited.

42351 **APTIC NO. 64078**

Ruff, Ronald E.

A COMMON DATA BASE FOR AIR QUALITY MODELING. *Preprint, North Atlantic Treaty Organization, Brussels (Belgium), Committee on the Challenges to Modern Society, 5p., 1974 (?). (Presented at the Expert Panel on Air Pollution Modeling, 5th Meeting, 1974.)*

A data bank for a test and comparison of air quality models which would reside on a universally compatible magnetic tape would be very useful. It would consist of a test data set of about 30 days, consisting of 1-hour averages for wind speed and direction, atmospheric stability, pollutant concentrations, and emission inventory estimates. The need for common data and the availability of various data base systems are discussed.

42352 **APTIC NO. 65821**

Shimaguchi, Shin, Yukio Masumoto, Akira Okada, and Akira Nakamura

AIR POLLUTION MONITORING AND CONTROL SYSTEM IN ISHIKAWA PREFECTURE. *(Ishikawa-ken taiki osen kanshi seigyo shisutemu). Text in Japanese. Fujitsu, 25(4):11-29, 1974. 4 refs.*

The Air Pollution Monitoring and Control System of the Ishikawa Prefecture is described. The system monitors and regulates pollution in a specific high-density pollution area and captures correct data on the current state of pollution in a specific low density pollution area. It forecasts the possible effects of a new source of pollution. The system gathers online monitoring data on the environment and specific sources of pollution, compares them with various environment monitoring reference values and pollution exhaustion regulatory references, displays the results on various display units, and makes at listing via logging typewriter. When the sulfur oxide, oxidants, and other pollutants exceed the critical reference values, the system performs simultaneous communication to schools and health offices and issues a simultaneous command to the sources of pollution. The system consists of two minicomputers FACOM U-200s, one for online and the other for offline use.

42353 **APTIC NO. 66055**

Snyder, Daniel J., III

DISTRICT OF COLUMBIA. STATE IMPLEMENTATION PLANS; PROPOSED COMPLIANCE SCHEDULES. *Federal Register, 39(163):30166-30167, Aug. 21, 1974.*

Some of the revisions to the District of Columbia state implementation plan compliance schedules are approved. Others are still undergoing review and cannot be approved at this time. Each proposed revision establishes a date by which an individual air pollution source must attain compliance with an emission limitation of the state implementation plan. Comments may be submitted on the proposed revisions.

42354 **APTIC NO. 66063**

Snyder, Daniel J., III

DISTRICT OF COLUMBIA. PROPOSED REVISION TO IMPLEMENTATION PLAN. *Federal Register, 39(134):25502, July 11, 1974.*

A proposed revision to the District of Columbia implementation plan is described, and comments are solicited. The revision will prohibit visible emissions from stationary sources, provided that discharges not exceeding 20% opacity shall be permitted for 2 min in any 60 min period and for an aggregate of 12 min in any 24-hour period.

42355 **APTIC NO. 66070**

Snyder, Daniel J., III

WEST VIRGINIA IMPLEMENTATION PLAN. PROPOSED COMPLIANCE SCHEDULES. *Federal Register, 39(156):28906, Aug. 12, 1974.*

Proposed revised compliance schedules are presented for the West Virginia state implementation plan. Each proposed revision establishes a date by which an individual air pollution source must attain compliance with an emission limitation of the state implementation plan. The date is indicated as the final compliance date. All compliance schedules are available for inspection. Comments on the revisions are solicited.

42356 **APTIC NO. 66058**

Strelow, Roger

NEW HAMPSHIRE. OPEN BURNING REGULATION. *Federal Register, 39(133):25330, July 10, 1974.*

A revision to the New Hampshire state implementation plan is proposed, and comments are solicited. The revision seeks to remove all cities and towns with a population of less than 5000 from the open burning regulation so that the need for individual compliance schedules for these towns and cities is precluded.

42357 **APTIC NO. 63727**

Svore, Jerome H.

STATE OF NEBRASKA. PROPOSED REVISION TO IMPLEMENTATION PLAN. *Federal Register, 39(131):24921-24922, July 8, 1974.*

Receipt of a proposed change in the State of Nebraska Implementation Plan is acknowledged along with a request for public comment. New provisions in the proposed revision include: expansion of procedures for preconstruction review, addition of a new procedure for disapproving a construction permit application based on sulfur dioxide and particulate estimates from proposed sources, changes in the particulate emission standards for fuel burning sources, a new SO2 emission standard for fuel burning equipment, deletion of a nitrogen dioxide emission standard for fuel burning equipment, alteration of an open fire regulation, addition of a visible emissions regulation for diesel-powered motor vehicles, and the addition of a final date of compliance to the list of incremental dates required in a compliance schedule.

42358 **APTIC NO. 66049**

Svore, Jerome H.

IOWA: APPROVAL OF COMPLIANCE SCHEDULES. APPROVAL AND PROMULGATION OF IMPLEMENTATION PLANS. *Federal Register, 39(186):34302-34303, Sept. 24, 1974.*

Approval is proposed of revised compliance schedules for the Iowa state implementation plan. Each approved revision establishes a new date by which the individual source must comply with the applicable emission limitation in the Federally approved State implementation plan. This date is indicated under the heading final compliance date.

42359 **APTIC NO. 66067**

Svore, Jerome H.

IOWA. APPROVAL OF COMPLIANCE SCHEDULES. *Federal Register, 39(185):34064-34066, Sept. 23, 1974.*

The approved portions of revised compliance schedules for Iowa state plans for implementation of the national ambient air quality standards are listed. Each approved revision establishes a new date by which the individual source must comply with the applicable emission limitation in the Federally approved State implementation plan.

42360 **APTIC NO. 63726**

Train, Russell E.

PART 52 - APPROVAL AND PROMULGATION OF STATE IMPLEMENTATION PLANS. GASOLINE VAPOR RECOVERY REGULATIONS; CHANGES IN INITIAL COMPLIANCE DATES AND REQUEST FOR COMMENTS ON ALTERNATIVE SYSTEMS. *Federal Register, 39(118):21049-21053, June 18, 1974.*

A notice is presented which promulgates a delay in the dates for submission of control plans, submission of signed contracts, and initiation of construction for the installation of gasoline vapor recovery systems for vehicle refueling. Additional comment is requested concerning which types of systems should be required and on the possibility of accelerating the deadline for final compliance. The notice only involves so-called State II vapor control systems (automobile refueling) and does not change the control dates for Stage I, requiring recovery of vapors lost during other gasoline transfer operations. Topics covered in the notice include: the legal background of vapor recovery control, current Environmental Protection Agency regulations, vapor recovery control techniques, requirements for recovery efficiency, re-opening of the comment period, issues presented, and studies to date.

42361 **APTIC NO. 66047**

Train, Russell E.

APPROVAL AND PROMULGATION OF IMPLEMENTATION PLANS. ALABAMA; APPROVAL OF PLAN REVISIONS. *Federal Register, 39(154):28528, Aug. 8, 1974.*

Alabama state implementation plan revisions of Part 5.1 of the air pollution control regulations are disapproved by the Environmental Protection Agency for the vicinity of the Widows Creek Power Plant in Jackson County. The revision would have deleted the present County classification system and associated emission limits for sulfur oxides from fuel combustion sources and would have replaced them by a different area classification system and less stringent limits. Such a revision would not have met all ambient sulfur dioxide standards in the area. The disapproval leaves in force the emission limit of 1.2 lbs SO2/10 to the 6th power BTU input which originally applied to the facility in question.

42362 **APTIC NO. 64369**

Utsunomiya, Makoto

THE PRESENT AND FUTURE OF REGULATIONS. *(Kisei no genjo to shorai). Text in Japanese. Sangyo to Kankyo (Ind. Environ.), 3(6):29-33, June 1974.*

The environmental standard based on the threshold value of pollutant concentrations which are harmful to humans and the environment is determined by ground level concentrations regardless of the quantity of pollutant. The total quantity regulation is one criterion of environmental control. Presently, the total quantity regulation is adopted by 13 local municipalities for sulfur oxides control in some highly polluted areas. Since the environmental capacity can not be measured with present technology, the regional permissible emission quantity to maintain environmental pollution levels below certain values or the standard determined based on the regional emission quantity of pollutant and maximum pollutant concentration are used. The pollution forecast based on the SOx emitted from combustion sources, which is affected by meteorological factors such as wind velocity, wind direction, and temperature distribution, is made by computer simulation or by wind tunnel tests. The important point of the total quantity regulation is that it it based on the pollution forecast; however, the present total quantity regulations are mostly based on the fuel consumption quantity. The aspects of environmental assessment and air pollution monitoring systems are also discussed. The reduction in gap between the ideal regularatory method and a realistically and technologically feasible regulatory method is a future task.

42363 **APTIC NO. 61074**

LAW FOR PROTECTION FROM HARMFUL ENVIRONMENTAL EFFECTS DUE TO AIR POLLUTANTS, NOISE, VIBRATIONS AND SIMILAR PROCESSES (FEDERAL IMMISSION PROTECTION LAW - BIMSCHG). *(Gesetz zum Schutz vor schaedlichen Umwelteinwirkungen durch Luftverunreinigungen, Geraeusche, Erschuetterungen und aehnliche Vorgaenge (Bundes-Immissionsschützgesetz-BImSscG). Bundesgesetzblatt, vol. 15, March 1974. 14 refs. Translated from German, 65p.*

A German law is set forth for the protection of humans, as well as plants, animals, and other objects, from harmful environmental contaminants resulting from air pollution as well as other types of pollution. The contents include: general provisions; construction and operation of plants; determination of emissions and immissions; quality of plants, materials, products, and fuels; condition and operation of vehicles and construction and modification of streets and railways; monitoring of the air pollution in the German Federal Region and plans for maintenance of air quality; and common and final provisions.

42364 **APTIC NO. 63873**

Japan Environmental Agency, Tokyo, Air Quality Bureau

AN OUTLINE FOR THE IMPLEMENTATION OF PHOTOCHEMICAL AIR POLLUTION INVESTIGATIONS IN THE OSAKA BAY AREA. *(Kokagaku hanno ni yoru taiki osen taiki chosa (Osakawan chiiki) jisshi yoko). Text in Japanese. 10p., July 1974.*

The air pollution and weather conditions of the Osaka Bay area are to be investigated as basic material for studies of the photochemical conditions there. The cooperating prefectures which will also come under this investigation are Osaka, Kyoto, Hyogo, Nara, and Wakayama. The vertical distribution investigation of pollutants will be made by kiloons on nitrogen oxides, oxidants, total hydrocarbons, methane, carbon monoxide, and temperature at four points between the ground and the altitude of 300 m, five times between 8 am and 5 pm. The vertical investigation will be made also on nitric oxide, nitrogen dioxide, the mountains behind Osaka and Kobe at about 10 locations. In Osaka Bay, sulfur dioxide, wind direction and wind velocity will be measured by boats. The meteorological investigations of the wind direction, temperature gradient, and air movements will be investigated by kitoons, pilot balloons, low altitude radiosonde, and nonlift balloons. The upper altitude and large area investigations of NO2, aerosol, ozone, temperature, and the ground surface temperature will be conducted by an airplane. The cross section measurements of NO2 will be taken by an automobile crossing the air current of southern Kyoto. Mobile dispersion investigations will be conducted by air tracers. The ground measurements of various pollutants will be obtained from the records of continuous monitoring stations in the area; these include the wind direction and velocity, temperature, humidity, sunshine quantity, sulfur oxides, dusts, nitric oxide, nitrogen dioxide, oxidants, hydrocarbons, and CO.

42365 **APTIC NO. 64176**

Argonne National Laboratory, Argonne, Ill., Energy and Environmental Studies Div. and American Society of Planning Officials, Chicago, Ill.

INTERAGENCY COOPERATION IN COMPREHENSIVE URBAN PLANNING AND AIR QUALITY MAINTENANCE. *Office of Air and Water Programs, Environmental Protection Agency Interagency Agreement EPA-AIG- 0159(D), Rept. EPA-450/3-74-027, 29p., March 1974.*

NTIS: PB-231 993/AS

The interagency relationships were studied among state and local air pollution control agencies and comprehensive planning agencies. A questionnaire was developed that explored the potential for planning agencies and air pollution control agencies working together to achieve air quality goals. The questionnaire was submitted to 900 public planning agencies. Few agencies specifically consider air quality in the vital areas of land use planning and transportation planning, and even fewer consider it in other functional areas such as housing, open space, or redevelopment. Most agencies lack primary responsibility for developing utility extension policies or zoning tools such as emission density zoning and air zoning, which they could use to influence air quality through their planning programs. There are no incentives from the EPA for state and local air pollution control agencies to use the planning community as a resource. Air pollution control guidelines have suggested that transportation and land use controls be considered in the development of implementation plans, but no specific guidelines on how this should be accomplished have been published. The EPA has published information and quantitative methods of air pollution analysis, but the record shows lack of general use of this information by the planning community. (Author abstract modified)

42366 **APTIC NO. 64239**

Environmental Protection Agency, Washington, D. C.

PROGRESS IN THE PREVENTION AND CONTROL OF AIR POLLUTION IN 1973 (ANNUAL REPORT). *103p., Jan. 1974.*

Progress made by the Environmental Protection Agency during the first 10 months of 1973 in the control and prevention of air pollution is reviewed. One-year suspensions of the statutory 1975 hydrocarbon and carbon monoxide and 1976 nitrogen oxides emission standards for light duty motor vehicles were granted. Transportation control plans were developed or approved for Air Quality Control Regions as required. The annual secondary sulfur oxides ambient air quality standard was revoked. New source performance standards were proposed for seven additional sources. National emissions standards for hazardous pollutants were promulgated for asbestos, beryllium, and mercury. Effective July 1, 1974 air polluters will be ineligible for certain Federal contracts, grants, and loans. Compliance schedules were promulgated for some stationary sources. In the center of selected cities, the average concentrations of total suspended particulates dropped 20% over the past 12 years and average SO2 concentrations dropped 50%. The sulfur oxides control technology development program is demonstrating adequate control technology for utility boilers to support immediate regulatory needs. Non-utility sources of SOx are becoming the focal point of control system development. Control technology for fine particulates is seriously deficient. Financial support of state and local control agencies increased to $50.5 million in fiscal 1973 as compared to $42.1 million in 1972. (Author summary modified)

1973

42367 **APTIC NO. 64198**

Adams, Robert C. and Marc S. Herlands

URBAN TRANSPORTATION ASPECTS OF THE CLEAN AIR ACT: A CASE STUDY OF THE WASHINGTON AREA (FINAL REPORT). *Consortium of Universities, Washington, D. C., Urban Transportation Center, Dept. of Transportation, Washington, D. C., Urban Mass Transportation Administration, UMTA-DC-11-0003-73-10, DC-110003, 61p., May 1973. 71 refs.*

NTIS: PB-225 939

A theoretical analysis of implementing urban transportation controls in compliance with the Clean Air Act of 1970 and a case study of the District of Columbia are presented. An analysis of air pollution in Washington, D. C. includes the amounts and sources of nitrogen oxides, photochemical oxidants, and carbon monoxide. Legal methods of alleviating the situation include state authority and private rights of action and possible local legislation. The interjurisdictional nature of the problem in the District and previous attempts to regulate air pollution are described. The Act places primary responsibility of reducing pollution on the states, but it reserves sufficient Federal power to intercede if necessary. Federal justifications are included and certain court cases are described including possible constitutional problems. The case study in the District includes a mandate for transportation planning, history and recommendations of the Air Quality Act of 1967, and the implementation plan for transportation proposals including general considerations for parking surcharge with particular applications to Maryland, Virginia, and the District and resultant constitutional objections. (Author abstract modified)

42368 **APTIC NO. 64015**

Adler, Gerald M.

LEGAL CONTROL OF INDUSTRIAL AIR POLLUTION IN ISRAEL. *Society of Engineering Science, Pollut. Eng. Sci. Solutions, Proc. Int. Meet. Soc. Eng. Sci., 1st, Tel Aviv, Israel, 1972, p. 651-663, 1973. (June 12-17.)*

Israel has no comprehensive legislative code for environmental protection generally, and air pollution control in particular. Rather, it has over 20 statutes and other enactments, of which about half relate to air quality. Responsibility for setting standards, coordinating programs, and enforcing laws is distributed among various governmental bodies, both central and local, on a pragmatic principle. The situation is analyzed from a functional viewpoint including laws and regulations regarding the planning of an industrial location, the implementation of policy in the establishment and construction of industrial plants, the management of industrial operations, and private and governmental supervision of air quality, external to the industry.

42369 **APTIC NO. 64190**

Berge, Helmut

ENVIRONMENTAL PROTECTION, AN INTERNATIONAL PROBLEM. *(Umweltschutz, ein internationales Problem). Text in German. Naturw. Rundschau, 26(12):507-515, Dec. 1973. 13 refs.*

General aspects of environmental protection as an international problem are discussed. The need for international cooperation in research and in the elaboration of more or less uniform air quality standards has been increasingly realized in the highly developed industrial countries for the last few years. However, certain underdeveloped countries, such as Brazil and India, tend to give priority to development over environmental concerns. On an international level, it is now more important to coordinate the activities of numerous research institutions than to create new ones. The identification of pollutants and ecological hazards, the creation of a worldwide environmental monitoring system and an international information system, the elaboration of internationally adopted quality criteria, and international actions for the prevention of further environmental contamination are the basic concerns in an international environmental policy.

42370 **APTIC NO. 65958**

Busterud, John A.

STATE OF THE ENVIRONMENT AN AGENDA FOR 1973. *Louisville Univ., Ky., Speed Scientific School, En-*

viron. Eng. Sci. Conf., Proc. 3rd Annu. Meet., Louisville, Ky., 1973, p. 367-377. (March 5-6.)

Environmental quality and its improvement are discussed. The Environmental Protection Agency is working closely with the states in devising state wide implementation plans for achieving national air quality standards. Air quality is improving in urban areas, and emissions from automobiles and stationary sources are decreasing. The sulfur oxides emission charge and the mined area protection bill are designed to insure that environmental damage is abated and that the costs of doing so will be included in energy prices. The level of enforcement against polluters was increased by statutes and executive orders.

42371 **APTIC NO. 65952**

Carroll, Julian M.

KEYNOTE ADDRESS. *Louisville Univ., Ky., Speed Scientific School, Environ. Eng. Sci. Conf., Proc. 3rd Annu. Meet., Louisville, Ky., 1973. p. 5-9. (March 5-6.)*

Environmental measures enacted by the 1972 General Assembly of Kentucky are outlined. A Department of Environmental Protection was created and includes an air pollution control division. A bill was enacted creating an interstate environmental impact between Kentucky and bordering states. A bill was passed establishing fines for motor vehicle air pollution. There is a bill requiring licensing and testing of pesticides applicators and operations and classification of certain pesticides for restricted use. A bill was passed to increase the fees of strip mine operations and to regulate surface activities of deep mine operations.

42372 **APTIC NO. 64101**

Detrie, Jean-Paul

KNOWLEDGE AND INFORMATION FOR A BETTER ENVIRONMENTAL PROTECTION. THE ROLE OF C.I.T.E.P.A. *(Connaitre et informer pour mieux proteger l environment. Role du C.I.T.E.P.A.). Text in French. Rev. Gen. Thermique (Paris), 1973.*

The environmental protection-related research and documentation and information activity of C.I.T.E.P.A. (Interprofessional Technical Center for Air Pollution Studies), a French institution established in 1961 for the coordination, promotion, pursuit and dissemination of studies and scientific and technical research on air pollution, is overviewed. Studies and research currently conducted by C.I.T.E.P.A. are primarily concerned with measurement methods and their standardization, pollutant dispersion, and pollution prevention, as well as with related information and documentation. Directives for stack height calculation in view of sulfur dioxide and particulate emission abatement, and emissions standards for cement works, waste incinerator plants, ore dressing plants, foundries, steel converters, and stationary combustion equipment have been recently elaborated.

42373 **APTIC NO. 64017**

Donagi, A. E., M. Naveh, A. Manes, M. Rindsberger, Y. Gat, and A. Friedland

A DUAL-PURPOSE AIR POLLUTION ALERT AND IMPLEMENTATION SYSTEM FOR THE GREATER TEL AVIV AREA. *Society of Engineering Science, Pollut. Eng. Sci. Solutions, Proc. Int. Meet. Soc. Eng. Sci., 1st, Tel Aviv Israel, 1972, p. 671-679, 1973. 6 refs. (June 12-17.)*

A large complex of power plants exits in north Tel Aviv which releases an emission of 150 tons/day of sulfur oxides and 250-750 kg/day of particulates. In addition, there are many low level sources in the area. Together, these sources constitute a possible air pollution hazard which required an air pollution alert and implementation system to be set up for metropolitan Tel Aviv. The purpose of the system is to keep air pollution levels within the limits specified by Israel ambient air quality standards. The monitoring station has been in existence since 1964. It measures sulfur dioxide, soiling index, nitrogen oxides, carbon monoxide, hydrocarbons, and wind. The alert and implementation procedure is described. Meteorological forecasts are made which may require a pollution forecast if meteorological conditions are expected to produce high levels of pollution. An alert may be called if forecasted pollutant concentrations exceed certain levels. Four operational statuses are then designated depending on expected air quality. So far the power plant complex has not caused any severe air pollution episodes in the area. However, the alert system would effectively control conditions leading to such an episode if necessary.

42374 **APTIC NO. 65949**

Ireland, F. E.

LEGISLATION: ITS IMPACT AND FUTURE TRENDS. *Inst. of Fuel, London (England), Fuel Environ. Proc. Conf., Eastbourne, England, 1973, p. 149-155. (Nov. 26-29, Paper 13.)*

British common and statute law is reviewed in relation to pollution control, with the Clean Air Acts of 1956 and 1968, the Alkali Act of 1863, and the 1960 Radioactive Substances Act being cites as principal tools for controlling air pollution in particular. The Clean Air Acts of 1956 and 1968 regulate emissions to air from the combustion of solid, liquid, and gaseous fuels and regulate the heights of new industrial chimneys. The Alkali Act gives the inspectorate wide powers of control over emissions from registered works. Estimates of emissions from registered works are attempted periodically to obtain information on which to assess progress. Under the Radioactive Substances Act, recommendations of the International Commission on Radiological Protection and the Medical Research Council are used to assess the emission hazards from nuclear installations in order to establish appropriate control measures where indicated. Annual cost estimates are given for pollution from industrial sources and motor vehicles and for total air pollution; the largest mean damage costs are in the areas of agriculture and health and are estimated to constitute 80% of the current economic costs.

42375 **APTIC NO. 65955**

Moyseenko, Helmut and N. Thomas Stephens

AN AIR RESOURCES MANAGEMENT MODEL FOR A SELECTED URBAN AREA. *Louisville Univ., Ky. Speed Scientific School, Environ. Eng. Sci. Conf., Proc. 3rd Annu. Meet., Louisville, Ky., 1973, p. 141-172. 25 refs. (March 5-6.)*

A methodology was developed for a general air resource management program and an evaluation system by which air pollution concentrations can be quantified and various control strategies can be evaluated. The program was based on carbon monoxide and applied to the Roanoke Valley in Southwestern Virginia. An inventory of the location and daily emission rates based on automotive emission controls and subsequent CO concentration levels after atmospheric diffusion is provided. Assessment of CO levels was calculated for 1971 and predicted for 1980. A Gaussian diffusion model was revised and concatenated with an emission inventory model. The inventory model can quantify the CO emissions from mobile sources at various driving speeds and varying degrees of emission controls for any given road network providing the coordinates, road length, average route speed, and the traffic volumes are known. Control strategies are enumerated emphasizing the need to integrate air resource management with urban and regional interdisciplinary viewpoints. Portions of the study area are in violation of the EPA CO standards, under adverse meteorological conditions. (Author abstract modified)

42376 **APTIC NO. 63623**

Papetti, R. A., S. H. Dole, and M. Hammer

AIR POLLUTION AND POWER PLANT SITING IN CALIFORNIA. *Rand Corp., Santa Monica, Calif., California State Assembly Contract LCB-21001,* *Rockefeller Foundation Grant RF-71015 Rept. R-1128-RF/CSA, 60p., March 1973. 30 refs.*

The contributions of fossil fuel burning power plants to air pollution in California are discussed and their relationship to decisions on possible powers and duties of a Power Plant Siting Authority in California are explored. The contributions of gas and oil burning power plants to air pollution in California compared with those from other emission sources, are, at present, significant, but not dominant, sources of nitrogen oxides, sulfur oxides, and particulate matter, particularly in the coastal air basins. Proportionately, power plants are expected to accounted for a somewhat larger share of the contaminants emitted into the air in the future as the other sources, particularly the automobile, become controlled more strictly. The extensive body of laws, regulations, and government organizations have the primary or sole functions to achieve and maintain air quality adequate to protect public health and welfare are described. There now exists a well integrated system of air resource management and planning at local, state, and federal levels that is directed toward achieving and maintaining air quality at a level adequate to protect the public health and welfare in California. It is suggested that the proposed Power Plant Siting Authority should not be given the power or responsibility to preempt or duplicate any of the air pollution control activities of concurrently existing air pollution control agencies in the state. It is suggested that the prevailing responsibilities for air pollution control remain within the existing agencies. (Author summary modified)

42377 **APTIC NO. 65947**

Persson, Goran A.

PROBLEMS, POLICY AND PRACTICE IN THE INTERNATIONAL FIELD. *Inst. of Fuel, London (England), Fuel Environ. Proc. Conf., Eastbourne, England, 1973, p. 135-140. (Nov. 26-29, Paper 11.)*

Legislative control of air pollution in Western European nations is reviewed in terms of the extraction, transport, storage, processing, and use of fuels in connection with stationary sources, motor vehicle operation, and nuclear power generation. The greatest impact of air pollution control for fuel combustion in stationary sources will be on the petroleum industry s products. Desulfurization of residual fuel oil will probably become a general requirement in most of the northern European countries by 1980. During most of the remainder of the decade, the allowable maximum sulfur content of residual oil will probably be 1%, and within the next three to five years the maximum S content of distillates will be 0.3% in most European countries. Motor vehicle fuel quality specifications will probably not require lead-free gasoline within the present decade due to more stringent exhaust emission standards. Legislation governing the use of private cars in urban areas and the specific fuel consumption of the internal combustion engine will lead to a slower growth of petroleum consumption. Increasing concern about the disposal of nuclear waste may cause a delay in the growth of nuclear power. Data are tabulated for various fuel processes and resultant environmental effects, technical data and emission factors for oil-fired stationary sources, and examples of possible energy savings.

42378 **APTIC NO. 65933**

Taussig, Joseph K., Jr.

FEDERAL LAWS FOR ENVIRONMENTAL CONTROL. *Louisville Univ., Ky., Speed Scientific School, Environ. Eng. Sci. Conf., Proc. 3rd Annu. Meet., Louisville, Ky., 1973, p. 19-29. (March 5-6.)*

A functional approach to Federal Laws for Environmental Control is presented. Regulatory statutes are invariably based on the foundation of some broad policy. The policy must be realistic and fiscally workable. Cognizance is always assigned to one or more organizational entities of the Federal government. The National Environmental Policy Act of 1969 is the foundation for the highest levels of Policy and Cognizance. It established the Council on Environmental Quality which is the major governmental organization directly advising the administration on trends, problems, and general solutions.

42379 **APTIC NO. 64413**

Public Nuisance Control Office, Kanagawa Prefecture

THE SITUATIONS ABOUT ENFORCEMENT OF MAJOR ITEMS BASED UPON THE AIR POLLUTION PREVENTION LAW. *(Taiki osen boshi-ho ni motozuku shuyo jiko seko jokyo). Text in Japanese. Kanagawa-ken Taiki Osen Chosa Kenkyu Hokoku (Tech. Rept. Air Pillution Yokohama-Kawasaki Ind. Area), no. 15:211-214, Feb. 1973.*

Yokohama constitutes 40.7%, Kawasaki 24.4%, Fujisawa 5.3%, Yokosuka 4.5%, and Chigasaki 3.3% of the total 7181 dust-emitting facilities which consist of 65.8% boilers, 12.5% metal heating furnaces, 5.1% dryers, and 3.6% waste incinerators. Particle-emitting facilities are classified into 46.6% belt-conveyers, 24% disposal stacks, 17% crushing machines and 13% sieves. The annual consumption by factories and operating places reached 7.34 million kl of heavy oil and 2.61 million tons of coal. A tendency toward increasing heavy oil consumption has existed since 1971. There has been, on the other hand, a rapid decrease in coal consumption. Sulfur content in heavy oil has decreased year by year. It was 2.3% in 1967, 1.96% in 1968, 1.55% in 1969, and 1.29% in 1970. An 18% decrease for 1972 was recorded. Kanagawa Prefecture has made an effort to establish emergency measures against sulfur oxides and oxidant. The emergency measures for 1971 cover factories and operating places with facilities capable of emitting 10 N cu m/hr of sulfur oxides. There are 34 factories in Yokohama, 44 in Kawasaki, and 45 in the other areas of the Prefecture which exceed 10 N cu m/hr in normal operations. The total sulfur oxides volume emitted in normal operations was 14801.8 N cu m/hr, of which 4413.9 N cu m/hr was for Yokohama. Since the mechanism of photochemical pollution are identical to those of sulfur oxides.

42380 **APTIC NO. 64414**

Public Nuisance Control Office, Kanagawa Prefecture (Japan)

ABOUT AMENDMENTS OF THE MAIN ITEMS IN COUNTERMEASURES ADOPTED IN CASE OF AN EMERGENCY CAUSED BY AIR POLLUTION. *(Taiki osen kinkyuji no sochi yoko no kaisei ni tsuite). Text in Japanese. Kanagawa-ken Taiki Osen Chosa Kenkyu Hokoku (Tech. Rept. Air Pollution Yokohama-Kawasaki Ind. Area), no. 15:215-225, Feb. 1973.*

Based upon amendments of the Air Pollution Prevention Law in June 1971, measures to be adopted in case of an emergency were expanded and reinforced to set up specific conditions concerning sulfur oxides, suspended particles, nitrogen oxides, carbon monoxide, and oxidant. Automobiles and dust exhausters are covered by the regulations. There are 4 stages for SOx: stage 1 is a state of 3-hr long pollution of more than 0.2 to 1 ppm/hr sulfur content in the air, while stage 4 is from 0.15 to 1 ppm/hr for 48 hr. Countermeasures are to be adopted when the pollution stays at a level of 2.0 mg/cu m for 2 hr in the case of suspended particles, when CO reaches 30 to 1 ppm, and when nitrogen dioxide and oxidant reach 0.5 to 1 ppm and 0.15 to 1 ppm per hr respectively.

1972

42381 **APTIC NO. 64152**

Crocker, Thomas D.

ON AIR POLLUTION CONTROL INSTRUMENTS. *Loyola Los Ang. Law Rev., 5(2):280-297, April 1972. 38 refs.*

An assessment of the shortcomings of currently favored control measures for air pollution abatement is given, and the proposal is made that air pollution control agencies define emission rights and sell them on a competitive bidding basis. The emission rights would be defined in terms of allowable emission quantities conditioned upon the assumption of specified values or ranges of values by meteorological, temporal, and spatial parameters that are presumed to be relevant. A procedure in which a control agency makes invariant and known use decisions to last for a fixed period of time while the market then allocates the air resource among users appears to have several economically desirable properties.

42382 **APTIC NO. 63615**

Croke, E. J., K. G. Croke, and J. E. Norco

THE ROLE OF TRANSPORTATION DEMAND MODELS IN THE PROJECTION OF FUTURE URBAN AND REGIONAL AIR QUALITY. *Society of Automotive Engineers, Inc., New York, Environmental Protection Agency, and Dept. of Transportation, Soc. Automotive Engrs. Int. Conf. Transp. Environ., Proc., Washington, D. C., 1972, Part I, p. 295-305. 7 refs. (May 31-June 2, Paper 720644.)*

Demand models can be used in the evaluation of certain transportation air quality-oriented policy statements regarding the effect of present efforts to reduce emissions from automobiles or to design pollution-free transportation systems. A transportation air pollution model is described. Two policy applications using this model are described to illustrate the sequence of steps required to use transportation data in an air quality model and to indicate how a transportation air quality model can be used as a policy evaluation tool. These policy evaluations are: the reduction of automotive emissions of hydrocarbons, carbon monoxide, and nitrogen oxides in the Chicago metropolitan area that would be achieved by the current Federal automotive emission standards; and the reduction of these pollutants that would be achieved by applying both the Federal standards and a proposed Chicago ordinance which initiates an automotive inspection-maintenance system. (Author abstract modified)

42383 **APTIC NO. 65881**

Lee, Norman and Christopher Wood

PLANNING AND POLLUTION. *Town Plann. Inst. J., vol. 58:153-158, 1972. 34 refs.*

The role of the planner in the control of pollution is discussed. The nature of air, water, land, and noise pollution is reviewed. Planning responsibilities in relation to pollution control and the complex question of planning objectives in controlling pollution are examined. Planning practice and the methods available in considering pollution in the preparation of plans and in development control are discussed. It is important to develop specific control objectives before starting control plans. The most suitable planning methods to implement the control objectives then must be identified. Pollution data collection at the sub-regional level could be valuable in traditional planning or in modeling studies. (Author abstract modified)

42384 **APTIC NO. 63595**

Lewis, Norman and Marvin Green

STATEWIDE SURVEILLANCE OF AIR QUALITY. *Technicon Corp., Tarrytown, N. Y., Adv. Autom. Anal., Proc. Technicon Int. Congr., New York, 1972, p. 59-64. (June 12-14.)*

The New Jersey State continuous monitoring program is described. Four sites in Bayonne, Ancora, Elizabeth, and Newark monitor pollution from trailers. Eighteen fixed stations also monitor pollution in center city commercial districts. Sulfur dioxide, carbon monoxide, and particulates are measured. The history of the system, the equipment operated at each trailer, the data recording system, and the information contained in the monthly reports are mentioned.

42385 **APTIC NO. 63424**

Roberts, R.

NWC AIR QUALITY MEASUREMENTS AND INSTRUMENTATION. *Naval Civil Engineering Lab., Port Hueneme, Calif., Proc. Nav. Environ. Prot. Data Base Instrum. Workshop, Port Hueneme, Calif., 1972, p. 241-244. (July 11-12.)*

NTIS, DDC: AD-772547

Air quality measurement and instrumentation programs at the Naval Weapons Center (NWC) are briefly discussed. The sources and conditions contributing to the reduced visibility at NWC are being identified and their contribution to the overall air quality determined. The particle size distribution will be measured in conjunction with chemical elemental analysis for fingerprinting the aerosol. The three-dimentional behavior of particulate matter and gases in the major air basins of California is being investigated. The mapping program will measure the gaseous pollutants nitrogen oxides, ozone, and carbon monoxide as a function of altitude and position over predetermined flight paths. The contribution of government agencies to air pollution and the effect of the existing pollution of flight operations at NWC and Edwards AFB are being investigated. Specific objectives are to determine: a historical record of air quality; air pollution patterns and trends; geographical sources and trajectories of air pollution, and improved techniques of observing and forecasting air quality and its interrelation with visibility are discussed.

42386 **APTIC NO. 63618**

Witherspoon, Robert

MOTOR VEHICLE RESTRAINTS FOR CLEAN AIR -- SOME IMPLICATIONS FOR AIR POLLUTION CONTROL POLICY. *Society of Automotive Engineers, Inc., New York, Environmental Protection Agency, and Dept. of Transportation, Soc. Automotive Engrs. Int. Conf. Transp. Environ., Proc., Washington, D. C., 1972, Part I, p. 334-339. 14 refs. (May 31-June 2, Paper 720648.)*

Air pollution control issues are discussed, complexities are reviewed, value conflicts and uncertainties are pointed out, and implications for public policy are discussed. Control procedures are hindered by a fragmented policy-making process. It is appropriate to proceed by seeking additional knowledge through research and experimentation before control policies are decided on. Research should start from the premise that motor vehicle restraints for clean air would probably entail measures much greater in scale and severity than currently contemplated. Measures of this magnitude imply practical and political problems of an entirely different order, and very probably, profound changes in city form and function as known today. (Author abstract modified)

1971

42387 **APTIC NO. 63410**

Black, J. W. C., R. M. Cooper, and D. T. Rattray

ENVIRONMENTAL LEGISLATION AND THE CANADIAN PAINT INDUSTRY. *Preprint, Chemical Coaters Assoc., 23p., 1971. (Presented at the International Anti-Pollution Coating Seminar, 1st, Chicago, Ill., Dec. 12-14, 1971.)*

Canada's paint industry has the potential of creating air and water pollution and faces problems in the disposal of solid and liquid wastes and in restrictions on the use of hazardous materials. Much effort has already been made at overcoming these difficulties. Increased effort must continue to be exerted to meet the considerable body of existing and impending legislation. Specific and nonspecific legislation relating to environmental effects caused by the paint industry is reviewed. Legislation covering water, air, soil, and solid waste pollution is covered. The major Canadian legislation covering air pollution control is the Clean Air Act which sets emission and air quality standards on a national basis and regulates fuel composition. It also enters into agreement with individual provinces to set specific emission standards and sets national emission guidelines to help the development of uniform regulations. Methods of abatement and causes of pollution in the paint industry are also mentioned. (Author conclusions modified)

42388 **APTIC NO. 63412**

Mayo, Francis T.

POLLUTION ABATEMENT - ENVIRONMENTAL PROTECTION AGENCY AND THE COATERS. *Preprint, Chemical Coaters Assoc., 6p., 1971. (Presented at the International Anti-Pollution Coating Seminar, 1st, Chicago, Ill., Dec. 12-14, 1971.)*

The Environmental Protection Agency s programs of industrial pollution abatement through enforcement are reviewed including water pollution implementation plans, the Refuse Act permit program, and schedules of compliance for air pollution implementation plans. Research by EPA into the air pollution effects of coating operations is minimal at present, as is regulation. A study to measure emissions from paint and varnish manufacturing operations will be used to set standards for new sources of pollutants. Some states and cities have passed regulations, however. A few research programs on air pollution from coating operations are reviewed.

1970

42389 **APTIC NO. 64283**

EQUITY AND THE ECO-SYSTEM: CAN INJUNCTIONS CLEAR THE AIR? *Mich. Law Rev., vol. 68:1254-1293, 1970. 199 refs.*

One of the methods of preventing environmental pollution is an injunction. An injunction is not a panacea, however, since it cannot effectively be used to combat problems of widespread concern. The nature of the air pollution problem, and the role of private litigation in combatting air pollution are reviewed. Prerequisites for injunctive relief are discussed including various types of damages. The power of the judiciary to decide cases and the jurisdictional difficulties in pollution cases are described. Several court cases are discussed. A number of traditional tort theories serving as the basis for injunctive suits against air polluters are described. A plaintiff not only must show that genuine disputes are justiciable, but must also show that he has a personal stake in the outcome of the controversy. The plaintiff who is able to show that pollution will cause actual or threatened economic loss to him or damage to his health will not face difficulty in establishing his standing. But in cases instituted by plaintiffs such as conservation groups, who must rely on amorphous injuries to intangible interests, the standing issue poses a real obstacle to successful litigation. The inadequacy of the remedy at law and the notion that a plaintiff s dely in bringing suit may bar him from obtaining injunctive relief (the doctrine of laches) are also discussed. The outcome of the case will depend on the merits of the case based on balancing the equities; thus the plaintiff s needs are balanced against the needs of the defendant and the community. The court can then enforce its decision through sanctions.

1955

42390 **APTIC NO. 63448**

Troy, William

DON T LEGISLATE--COOPERATE. *Petrol. Process., 10(3):354-356, March 1955.*

The pollution control philosophy of Cleveland is not to legislate pollution control, but rather to use joint government-industry cooperation. One result of this policy was a detailed study of local weather in relation to concentrations of air contaminants from 1949 to 1955. The aims of the study were to correlate the meteorological data with air pollution concentrations, to determine the kinds of weather favorable for retention and dispersion of air pollution, and to forecast the concentration of contaminants from weather data. The progress of this program from its early planning stages, through various decisions over the responsibilities of the industries involved, to actual samplings is reviewed. Some of the results of the program are discussed including the relationship between sulfur dioxide and wind, the relationship between SO2 and temperature, the effects of temperature inversions, and variations in SO2 concentrations.

SOCIAL ASPECTS

1973

42391 **APTIC NO. 64235**

Viladas, Joseph M.

THE AMERICAN PEOPLE AND THEIR ENVIRONMENT--1973: A STUDY OF NATIONAL OPINION AND ATTITUDES ABOUT ENVIRONMENTAL PROBLEMS AND THEIR SOLUTION (VOLUME I). *de Kadt Marketing and Research, Inc., Greenwich, Conn., J. M. Viladas Div., Environmental Protection Agency Contract, 222p., Nov. 1973.*

A national study was made of people s opinions and attitudes about the environmental by personally interviewing 3012 American adults. With few exceptions, people are concerned about the same sources of pollution and other types of damage to the environment regardless of area size. In metropolitan areas with 1 million or more people, 32% express a high degree of concern, in non-metropolitan areas, only 4% do. Nationally the top six concerns as shown by the percentage who rate the damage to the environment a lot or some are truck bus, and airplane exhaust 71%, automobile exhaust 69%, industrial smoke and gases 62%, untreated sewage 60%, solid waste 58%, and factory effluent 56%. Only 4% of the people feel air pollution is not a big problem, 12% have not decided, and 84% feel it is a big problem. Generally, people who are aware of the Environmental Protection Agency are more likely to have made their minds up about environmental issues and are more willing to pay the cost of improving the environment. A majority of car owners react favorably to an increase of $150 per car to pay for antipollution devices. It is estimated that at 1973 prices, an average increase of about $250 per car would be the maximum amount to receive the support of a majority of car owners. People are willing to pay an average increase of 22% in their monthly electric bills. When confronted with the need to choose between high prices and higher taxes in order to pay for pollution control, 62% of the people chose higher prices and 29% chose higher taxes.

GENERAL

1974

42392 **APTIC NO. 63738**

Fleischer, Michael, Adel F. Sarofim, David W. Fassett, Paul Hammond, Hansford T. Shacklette, Ian C. T. Nisbet, and Samuel Epstein

ENVIRONMENTAL IMPACT OF CADMIUM: A REVIEW BY THE PANEL ON HAZARDOUS TRACE SUBSTANCES. *Environ. Health Perspect., no. 7:253-323, May 1974. 261 refs.*

An extensive review of the element cadmium and its environmental impact is presented. Topics covered include: general properties and uses of the metal, environmental forms and sources, cadmium material flows, the effects of cadmium on man and experimental animals, the presence of cadmium in plants and animals and the resulting ecological effects, and trace analysis methods for cadmium. Smelting, metallic alloy manufacturing, and reprocessing of cadmium-containing alloys and cadmiumdplated materials account for about 90% of the cadmium of atmospheric emissions, estimated to be about 2300 metric tons annually in the United States. Data on the contents of cadmium in soils near point sources show that the fall-out results in high concentrations of cadmium close to the sources. Among plants, mosses appear to be especially good indicators of exposure to high concentrations of the metal. Exposure to fumes or dusts of cadmium metal or cadmium oxide is known to cause acute pulmonary edema in humans, and chronic human exposure can cause chronic emphysema and renal disturbance.

42393 **APTIC NO. 63776**

Gilbert, T.

SIMPLIFIED METHOD FOR THE CALCULATION OF MINIMUM CHIMNEY HEIGHTS IN CASES OF EMISSION OF GASEOUS FLUORIDE COMPOUNDS FROM BRICKWORKS. *(Vereinfachtes Verfahren zur Berechnung der Schornsteinmindesthoehen bei der Emission von gasfoermigen Fluorverbindungen aus Ziegeleien). Text in German. Ziegelind. (Weisbaden), no. 4:152-154, 1974. 7 refs.*

A simplified pragmatic method for the determination of the minimum stack heights in brickworks emitting gaseous fluorides is presented with respect to the problems involved in the application of the diagram given the Clean Air Manual to the calculation of the minimum stack height in such cases. The ground-level fluoride concentrations were evaluated for the immediate vicinity of the emission source under most unfavorable meteorological conditions. The wind speed and the evaluation period were 3 m/sec and 30 min, respectively. In view of the mainly rural location of brickworks, it is not expedient to use the dispersion parameters determined for urban conditions.

42394 **APTIC NO. 63961**

Loraine, J. A.

ENVIRONMENTAL POLLUTION IN THE 1970S. *Med. Lab. Technol., 31(2):97-103, 1974. (Presented at the I.M.L.T. Symposium on Future Trends in Clinical Chemistry, Liverpool, England, Sept. 1973.)*

The outlook for environmental air and water pollution in the 1970s is discussed. Radioactive pollution is also discussed. Presently more than 170,000,000 tons of man-made products are dumped into the air each year in the U. S. Urban areas are the most severely affected by pollution, and smog is an especially bad result which occurs in some cities such as Los Angeles. The automobile is the source of 90,000,000 tons of pollutants each year. Tokyo has also been affected by photochemical smog. It is probably that pollution will continue to increase in Tokyo, but various laws throughout the world to restrict air pollution may cause a reduction in pollution.

42395 **APTIC NO. 63883**

Odaira, Toshio

STUDY OF PHOTOCHEMICAL AIR POLLUTION IN JAPAN. *(Wagakuni ni okeru kokagaku sumoggu no kosatsu). Text in Japanese. In: Studies on Tokyo Smog. Tokyo Metropolitan Research Inst. for Environmental Protection (Japan), Rept. 3, p. 21-39, March 1974. 21 refs.*

Investigations and researches concerning the Los Angeles and Tokyo smogs are reviewed. They include the smog formation mechanism, formation factors, smog types and patterns, and the effects of oxidants on the human body, plants, animals, and materials. Warnings were issued against hourly oxidant concentration of 0.15 ppm or more in Japan seven times in 1970, all in Tokyo. In 1971, this increased to 98 with 33 in Tokyo, and 23 in Saitama; in 1972 there were 176 with 33 warnings in Tokyo, 31 in Kanagawa, 21 in Chiba, 19 in Hyogo, and 18 in Osaka; in 1973, there were 328 warnings with 45 in Tokyo and Saitama respectively, 30 in Kanagawa, 28 in Chiba, 26 in Osaka, 23 in Hyogo, and 21 in Ibaraki. Obviously, the frequency and areas of photochemical smogs are expanding. For instance, only seven prefectures issued oxidant warnings in 1971, but 21 prefectures issued warnings in 1973. Oxidant measurement equipment is also increasing. In October 1972, 177 oxidant automatic meters existed in all of Japan, but by April 1973, the number increased to 243. The number of people who were physically affected by smogs were 17,887 in 1970, 48,118 in 1971, 21,245 in 1972, and 31,966 in 1973.

42396 **APTIC NO. 65819**

Reinisch, K.

RELATIONSHIP OF CYBERNETICS TO THE ENVIRONMENT. *(Zum Verhaeltnis von Kybernetik und Umweltgestalung). Text in German. Mes.- Steuern-Regeln, 17(6):190-191, 1974. 9 refs.*

The tasks and possibilities of cybernetics in the control of the abiotic and biotic environment are outlined. Abiotic and biotic environment and human activity should be regarded as a unit in a closed system with multiple relationships. Human activity has its impact on both the abiotic environment (soil, water, and air) and on the biotic environment (flora and fauna), and also the two latter influence each other as well as human society and activity, generating instabilities. Cybernetic research in the environmental area should contribute to the optimization of the relationships between human activity and the environment in shifting the impetus from the expansion of industrial and agricultural production toward a sound balance between human activity and the environment, and toward environmental protection without the generation of secondary environmental hazards.

42397 **APTIC NO. 65862**

Russell, V. S.

POLLUTION: CONCEPT AND DEFINITION. *Biol. Conserv., 6(3):157-161, July 1974. 26 refs.*

Air pollution is defined by the Senate Select Committee Report on Air Pollution, Australia Parliament, 1969. It is the act of causing air to contain concentrations of foreign matter in excess or normal values and which adversely affect the health of human beings, their property and comfort, the comfort or health of animals, or the health of plants. This definition fails to differentiate between air pollution resulting from the controllable activities of man and the natural emissions of particulates and gases over which there is no control. More particulate matter and more combined gases were forced into the atmosphere by the volcanic eruptions of Krakutau in Java in 1883, by Mt. Katmai in Alaska in 1912, and by Mt. Hekla in Iceland in 1947 than by all the activities of a man in recorded history. Greenbelts aid in the dilution and removal of pollutants, but air pollution control should be regarded as an integral part of the industrial process, and responsiblity for it should lie with the industry, not with the municipal authorities responsible for parklands.

42398 **APTIC NO. 63695**

AIR HYGIENE IN ZURICH CANTON, FLUE GAS CONTROL AND THE USE OF A TESTING VAN. *(Lufthygiene im Kanton Zuerich, Feuerungskontrolle und Eisantz eines Messwagens). Text in German. Schweiz. Bauztg., 92(20):487-488, May 1974. 4 refs.*

Flue gas control procedures implemented in Zurich, Switzerland, are described with respect to the new emission standards. All firing equipment are controlled for proper functioning by the Bacharach test at least once every 2 years. A testing van is used for the measurement of soot, dust, hydrocarbons, and sulfur dioxide concentrations, as well as for recording the major meteorological parameters. It is also equipped for the determination of the sulfur and ash contents in fuels. The construction and conversion of large-capacity firing equipment consuming over 1000 kg solid or liquid fuel or over 1000 cu m natural gas hourly are subject to cantonal approval. Air pollution, especially that caused by small-size firing equipment, can be effectively abated by switchover from such equipment to remote heating.

1973

42399 **APTIC NO. 64241**

Garnett, Alice

ENVIRONMENTAL FACTORS AND AIR POLLUTION. *Institution of Chemical Engineers, London (England), Northwestern Branch and Salford Univ. (England), Proc. Int. Conf. Control Gaseous Sulphur Compd. Emiss., Salford, England, 1973, 36p. 11 refs. (April 10-12.)*

The diversity and complexity of influences affecting air pollution are discussed with reference to both artificial and natural environmental factors, and the nature of the general problems involved. With reference to hourly sampling data for smoke and sulfur dioxide, case studies are examined and possible relationships between the coincidence or otherwise of phases of both high smoke and high SO2 with variations in meteorological and climatological parameters are considered. Trends in both SO2 and smoke pollution since 1963 at sites in Sheffield characterizing different urban functional areas are discussed with reference to some climatological considerations, the implementation of smoke control and, changeovers in fuel to the use of sulfur free natural gas. (Author abstract)

42400 **APTIC NO. 61065**

Harada, Akira

THE BACKGROUND POLLUTION OF THE AIR. *Translated from Japanese. Environmental Sciences Library, 1973 (?), 159p.*

Background pollution in the atmosphere is reviewed for such pollutants as aerosols, carbon dioxide, sulfur compounds, oxygen, nitrogen oxides, hydrocarbons, carbon monoxide, radioactive species, and ozone. Topics presented include: the actual state of atmospheric background pollution in terms of characteristics, measurements, chemical reactions, and weather modifications; background pollution in the upper atmosphere, including upper atmospheric characteristics, upper clouds, water vapor, Junge s layer, and radioactive and nonradioactive pollutants; the total quantity of pollutants formed and forecasts of pollution levels, including the proportion of pollution sources accounted for by Japan; and research activities in the observation of background pollution.

42401 **APTIC NO. 64244**

Jolley, L. J.

THE CONTROL OF GASEOUS SULPHUR COMPOUND EMISSIONS: A SURVEY OF THE SITUATION IN THE UNITED KINGDOM. *Institution of Chemical Engineers, London (England), Northwestern Branch and Salford Univ. (England), Proc. Int. Conf. Control Gaseous Sulphur Compd. Emiss., Salford, England, 1973, 29p. 8 refs. (April 10-12.)*

A balanced appraisal of the control efforts of air pollution in the United Kingdom is presented. The problem of sulfur oxide emissions from the combustion of fuels needs further research as to the effects on vegetation, materials, and amenity. Information and experience in the United Kingdom of intensities and trends in air pollution and on its abatement by legislative and technological means is extensive and dates back several decades. Smoke control legislation and increased preference for clean and convenient fuels have been major factors in reducing ground-level concentrations of sulfur oxides in recent years. This reduction can be expected to continue at least until 1980. Ground-level concentrations of sulfur oxides, not the total of emissions, are the proper criteria for air quality appraisal. The aim of control should be to minimize emissions from chimneys at low levels: there is no evidence at present that would justify restricting emissions from sufficiently tall and suitably designed chimneys. It is not now possible to assign reliable figures to the economic and social costs of the pollution. A number of technological and other measures are available for reducing air pollution by sulfur oxides. Such measures include desulfurization of fuels and stack gases. These are expensive and in some cases of doubtful value. The most cost-effective strategies appear to be preferential use of low-sulfur fuels where their impact on ground-level concentrations of sulfur oxides is greatest, and overall economy in the use of fuels, especially in the domestic, commercial, and public-service sectors. The outlook for other European countries during this decade appears less favorable than that for the United Kingdom. In these countries both low-level and high-level emissions are likely to increase and they may wish to impose restrictions on sulfur content of fuels. International discussions should deal with the need for avoiding misallocation of such resources as low-sulfur fuels and for avoiding economic distortions. (Author abstract modified)

42402 **APTIC NO. 63463**

Stone, Ralph and Herbert Smallwood

INTERMEDIA ASPECTS OF AIR AND WATER POLLUTION CONTROL. *Environmental Protection Agency, Washington, D. C., Office of Research and Development, Contract 68-01-0729, Program Element 1H1093, EPA-600/5-73-003, 357p., Aug. 1973. 411 refs.*

GPO

On the basis of emission quantity, toxicity, and current conditions, the air pollutants sulfur oxides, sulfur compounds, nitrogen oxides, nitrogen compounds, heavy metals, particulates, carbon monoxide, hydrocarbons, fluorides, hydrogen chloride, arsenic, hydrogen cyanide, ammonia, and ethylene are discussed and classified according to the Standard Industrial Classification Code. The interaction and transport between air and water, sources, treatment, and fate of these pollutants are discussed. The environmental impacts, main sources, and control methods are discussed in detail for each pollutant. Mathematical models are given for various control strategies, cost information, and choice of control program. Intermedia pollution management in the city of Los Angeles is discussed in detail.

42403 **APTIC NO. 63577**

North Atlantic Treaty Organization Committee on the Challenges of Modern Society, Brussels (Belgium), Expert Group on Air Quality

AIR POLLUTION. AIR QUALITY CRITERIA RELATIVE TO NITROGEN OXIDES. *(Pollution Atmospherique. Criteres De Qualite De L Air Relatifs Aux Oxydes D Azote). Text in French. Rept. 15, 252p, June 1973. 268 refs.*

A complex study on the nature, sources, analysis, atmospheric levels, and interactions with meteorological factors, toxicological and other effects, and a related epidemiological study of nitrogen oxides are presented. Nitric oxide and nitrogen dioxide, originating chiefly in combustion processes in combustion equipment and internal-combustion engines, interact with hydrocarbons and thus lead to photochemical smog formation. Reduction of the combustion temperature and of the air-excess coefficient, as well as catalytic afterburning are among the basic means of reducing nitrogen oxides emissions. Nitrogen oxides are analyzed mainly by converting them into nitrogen dioxide for subsequent colorimetric determination. Measurements of NO and NO2 concentrations revealed correlation between these concentrations and the traffic density as well as the intensity of the ultraviolet radiation. Nitrogen oxides and their oxidation products discolor textile materials and accelerate corrosion of metals. Nitrogen dioxide interferes with photosynthesis and causes foliar lesions in plants especially during the period of the most intense growth. Epidemiological studies revealed increased morbidity of respiratory diseases and acute bronchitis, as well as reduced vital capacity in subjects, especially in children in areas with high NO2 concentrations.

1972

42404 **APTIC NO. 63794**

Kyoto Univ. (Japan)

ENVIRONMENTAL POLLUTION AND LIVING MATTER. *(Kankyo osen to seibutsu). Text in Japanese. 68p., Oct. 1972. 176 refs.*

Environmental pollution by pesticides and the effect on animals as well as the future problem were described. Results of an investigation carried out in America in 1966 showed that the average concentration of DDT and related compounds in air in urban area was 37.3 mg/cu m which was 10,000 times that in farm area. In Japan, the average concentration was believed to be higher. Strong wind and hurricane were found responsible for carrying pesti[illegible] from ground to air. The acute and chronic effects of t[illegible]sonous pesticides on fishes and birds as well as other an[illegible]s have been confirmed. As countermeasures for future pollution, using less poisonous and easy-decomposed pesticide at lower concentration and decreasing the time of application by choosing the effective period were proposed.

1970

42405 **APTIC NO. 64134**

Task Force on Air Pollution, Washington, D. C.

CLEANER AIR FOR THE NATION. *Aug. 1970, 41p.*

GPO

The report of the President s Task Force on Air Pollution and its control recommendations are presented. Sixty-three recommendations were developed and include both policy and technical matters and cover short-term as well as long-term needs. Recommendations on mobile source emission control include: fuel additives, emission testing and inspection, diesel engine emissions, air traffic, mass transit, catalysts, and advanced propulsion systems. Recommendations on stationary source emission control include: plant siting, regional capacity, large fossil fuel combustion sources, fuel conversion-coal gasification, nuclear power, future power production and transmission, commercial and domestic heating, solid wastes, and small power units. Recommendations on biological effects include: epidemiological studies, clinical investigations, physiological experiments, low-level radiation hazards, and plant and animal studies. Recommended analytical methods and instrumentation development cover: ambient air monitors, stack sampling and analysis, and specific needs. Recommendations for meteorological problems and considerations cover expanded forecasts, climatic effects of pollutants, stratospheric air pollution, and chemical reactions in the atmosphere.

SUBJECT INDEX

A

ABATEMENT
41235, 41499, 42300, 42302, 42307, 42308, 42339, 42368, 42372, 42383, 42386

ABSORPTION (CONTROL)
41317, 41328, 41334, 41348, 41354, 41357, 41364, 41394, 41445, 41471, 41489, 41545, 41572, 41582, 41588, 41602, 41606, 41666, 41676, 41703, 41725, 41783, 41785, 41798, 41839, 41994, 42038, 42052, 42097, 42114, 42162, 42175, 42185, 42194, 42208, 42289, 42313

ABSORPTION (GENERAL)
41254, 41297, 41307, 41308, 41309, 41320, 41332, 41342, 41350, 41351, 41360, 41387, 41391, 41392, 41423, 41433, 41460, 41484, 41485, 41501, 41503, 41505, 41514, 41515, 41516, 41517, 41522, 41523, 41529, 41534, 41546, 41553, 41561, 41567, 41578, 41587, 41613, 41618, 41638, 41651, 41664, 41665, 41673, 42305

ACETALDEHYDE
41785, 41826

ACETIC ACID
41670, 42127, 42198

ACETONE
41758, 42123, 42127

ACETYLENES
41278, 41760, 41770, 41882, 42027

ACID SMUTS
41382, 41578, 41762

ACROLEIN
41785, 41862, 42058, 42181

ACUTE
42108, 42187, 42190, 42207, 42255, 42392, 42404

ADAPTATION
42096, 42157, 42183

ADSORPTION (CONTROL)
41291, 41294, 41318, 41330, 41383, 41399, 41413, 41416, 41426, 41432, 41453, 41455, 41491, 41526, 41530, 41545, 41547, 41555, 41559, 41563, 41584, 41600, 41606, 41609, 41637, 41698, 41758, 41767, 41933, 42008, 42020, 42025, 42033, 42034, 42052, 42067, 42079, 42258, 42280, 42289

ADSORPTION (GENERAL)
41231, 41308, 41320, 41332, 41351, 41495, 41496, 41498, 41503, 41519, 41531, 41540, 41558, 41574, 41585, 41592, 41670

ADVECTION
41952, 41993

ADVISORY SERVICES
41688

AERODYNAMICS
41486, 41642, 41989, 42015, 42083, 42086, 42087, 42088, 42090

AEROSOL ATOMIZATION
41840, 41567, 42022, 42032, 42070, 42080, 42089, 42202

AEROSOL DIFFUSION AND BROWNIAN MOTION
41458

AEROSOL PHENOMENA
41223, 41265, 41333, 41363, 41374, 41384, 41390, 41409, 41417, 41429, 41433, 41444, 41454, 41456, 41458, 41544, 41587, 41613, 41624, 41676, 41685, 41686, 41703, 41707, 41718, 41724, 41737, 41748, 41765, 41790, 41792, 41810, 41819, 41832, 41834, 41836, 41838, 41840, 41841, 41842, 41845, 41848, 41854, 41855, 41858, 41863, 41868, 41871, 41876, 41877, 41882, 41892, 41897, 41911, 41954, 41967, 42004, 42008, 42009, 42012, 42013, 42019, 42022, 42024, 42031, 42032, 42037, 42047, 42062, 42070, 42078, 42080, 42081, 42082, 42084, 42085, 42089, 42091, 42152, 42158, 42202, 42385

AEROSOLS
41231, 41333, 41363, 41458, 41459, 41613, 41655, 41681, 41682, 41683, 41685, 41688, 41706, 41707, 41718, 41745, 41761, 41762, 41765, 41776, 41794, 41832, 41836, 41838, 41840, 41841, 41843, 41844, 41846, 41847, 41848, 41851, 41852, 41855, 41858, 41874, 41876, 41882, 41897, 41911, 41916, 41919, 41923, 41927, 41928, 41931, 41951, 41967, 41968, 41974, 41980, 41985, 41997, 41999, 42001, 42002, 42004, 42006, 42010, 42011, 42012, 42016, 42017, 42019, 42022, 42029, 42031, 42032, 42040, 42043, 42044, 42049, 42062, 42070, 42078, 42080, 42082, 42083, 42086, 42087, 42091, 42095, 42160, 42202, 42203, 42204, 42364, 42400

AFRICA
41953, 42097, 42205

AGRICULTURAL CHEMICAL PLANTS
41231, 41406, 41416, 41545, 41671, 41680, 41904

AGRICULTURAL SERVICES
41925

AGRICULTURE INDUSTRY
41925

AIR CONDITIONING EQUIPMENT
41362, 41378, 41575, 41686

AIR POLLUTION EPISODES
41869, 41910, 41948, 42101, 42115, 42133, 42332, 42344, 42373, 42379, 42380, 42395

AIR POLLUTION FORECASTING
41197, 41267, 41866, 41921, 41958, 41984, 42007, 42332, 42352, 42362, 42382, 42385, 42400, 42405

AIR QUALITY CRITERIA
42105, 42127, 42168, 42322, 42362, 42369, 42381

AIR QUALITY MEASUREMENT PROGRAMS
41266, 41286, 41373, 41731, 41736, 41760, 41799, 41804, 41812, 41829, 41845, 41848, 41849, 41850, 41852, 41853, 41857, 41860, 41864, 41867, 41869, 41873, 41874, 41875, 41876, 41879, 41881, 41883, 41886, 41887, 41888, 41889, 41890, 41892, 41894, 41895, 41896, 41897, 41898, 41900, 41901, 41902, 41903, 41904, 41906, 41907, 41908, 41909, 41910, 41911, 41921, 41922, 41924, 41935, 41937, 41948, 41949, 41950, 41956, 41964, 41969, 41997, 42009, 42013, 42092, 42093, 42096, 42101, 42102, 42111, 42134, 42154, 42163, 42182, 42247, 42256, 42258, 42260, 42261, 42264, 42337, 42344, 42352, 42363, 42364, 42367, 42373, 42384, 42390, 42391, 42395

AIR QUALITY STANDARDS
41231, 41234, 41281, 41490, 41492, 41545, 41849, 41867, 41893, 42139, 42153, 42291, 42315, 42323, 42324, 42327, 42335, 42339, 42341, 42345, 42349, 42359, 42362, 42366, 42369, 42370

AIR RESOURCE MANAGEMENT
41235, 41259, 41554, 41984, 42328, 42332, 42363, 42365, 42366, 42368, 42374, 42375, 42376, 42377, 42381, 42382, 42383, 42386, 42402

AIR-FUEL RATIO
41214, 41218, 41229, 41238, 41248, 41262, 41268, 41430, 41451, 41462, 41465, 41487, 41525, 41569, 41593, 41780

AIRCRAFT
41197, 41236, 41266, 41267, 41276, 41486, 41499, 41551, 41560, 41747, 41782, 41813, 41814, 41924, 41930, 41979, 41985, 42316, 42364, 42391

AIRPORTS
41266, 41276, 42316

ALABAMA
42317, 42342, 42350, 42361

ALCOHOLS
41230, 41322, 41431, 41514, 41588, 41672, 41728, 41758, 41820, 41822, 41964, 42018, 42127

ALDEHYDES
41230, 41248, 41257, 41322, 41753, 41757, 41768, 41785, 41820, 41821, 41826, 41844, 41862, 42018, 42041, 42054, 42058, 42064, 42110, 42127, 42181

ALERTS
41869, 41948, 42332, 42344, 42373

ALFALFA
41579, 42224

ALIPHATIC FRACTIONS
41202

ALKALINE ADDITIVES
41231, 41254, 41292, 41297, 41308, 41309, 41320, 41332, 41360, 41387, 41391, 41433, 41445, 41460, 41471, 41475, 41484, 41485, 41488, 41503, 41517, 41534, 41539, 41546, 41553, 41561, 41587, 41622, 41665, 42305

ALLERGIES
42106, 42142, 42184

ALPHA PARTICLES
41828, 42006

ALUMINUM
41406, 41439, 41531, 41865, 41958, 42289, 42317

ALUMINUM COMPOUNDS
41255, 41595

ALUMINUM OXIDES
41255, 41314, 41353, 41403, 41481, 41547, 41627, 41997, 42072

ALVEOLI
42094, 42103, 42122, 42125, 42136, 42140, 42160, 42253

AMIDES
41464

AMINES
41514, 41515, 41758, 41811, 41820, 41849, 42198

AMINO ACIDS
41527, 42099, 42120, 42168, 42173, 42192, 42194

AMMONIA
41195, 41291, 41312, 41317, 41320, 41347, 41368, 41382, 41418, 41471, 41479, 41503, 41510, 41527, 41545, 41588, 41630, 41638, 41640, 41700, 41785, 41849, 41860, 41923, 41929, 41996, 42030, 42035, 42072, 42282, 42285, 42402

AMMONIUM COMPOUNDS
41195, 41291, 41312, 41317, 41319, 41320, 41347, 41368, 41382, 41418, 41471, 41479, 41503, 41510, 41527, 41545, 41578, 41588, 41630, 41638, 41640, 41700, 41785, 41847, 41849, 41860, 41883, 41923, 41929, 41996, 42030, 42035, 42072, 42282, 42285, 42402

ANEMIA
42117, 42208

ANIMALS (NON-HUMAN)
41256, 41319, 41607, 42070, 42097, 42100, 42109, 42113, 42118, 42119, 42123, 42124, 42125, 42131, 42136, 42137, 42139, 42141, 42143, 42145, 42146, 42147, 42150, 42159, 42161, 42164, 42165, 42169, 42174, 42175, 42181, 42187, 42205, 42208, 42215, 42223, 42238, 42253, 42278

ANTHRACENES
41967

ANTHRACOSIS
42140

ANTIBODIES
42111

ANTICYCLONES
41875, 41953, 42001

ANTIDOTES
42198

ANTIGENS
42184

AREA EMISSION ALLOCATIONS
42328, 42365

AREA SURVEYS
41266, 41286, 41373, 41736, 41845, 41848, 41849, 41850, 41852, 41853, 41857, 41860, 41864, 41867, 41869, 41873, 41874, 41875, 41876, 41879, 41881, 41886, 41887, 41888, 41889, 41890, 41892, 41894, 41895, 41896, 41897, 41898, 41900, 41901, 41902, 41903, 41904, 41906, 41907, 41908, 41909, 41910, 41911, 41921, 41922, 41924, 41935, 41937, 41948, 41949, 41950, 41956, 41964, 41997, 42009, 42013, 42092, 42096, 42101, 42102, 42111, 42134, 42154, 42163, 42182, 42247, 42256, 42258, 42260, 42261, 42264, 42364, 42367, 42395

ARIZONA
42349

AROMATIC FRACTIONS
41202, 41927

AROMATIC HYDROCARBONS
41202, 41217, 41230, 41758, 41770, 41863, 41869, 41885, 41927, 42018, 42174, 42190, 42313

ARSENIC COMPOUNDS
41588, 41694, 42207, 42208, 42402

ASBESTOS
41281, 41500, 41707, 42097, 42105, 42152, 42172, 42186, 42199, 42205, 42366

ASBESTOSIS
42152

ASHES
41198, 41244, 41254, 41265, 41272, 41273, 41303, 41306, 41532, 41595, 41656

ASPHALT
41247

ASPIRATORS
42081

ASTHMA
42095, 42106, 42111, 42112, 42142, 42154, 42167, 42182

ATMOSPHERIC MOVEMENTS
41276, 41285, 41564, 41704, 41739, 41782, 41799, 41851, 41872, 41875, 41881, 41890, 41893, 41901, 41903, 41905, 41907, 41909, 41910, 41911, 41914, 41915, 41916, 41917, 41918, 41921, 41922, 41925, 41927, 41930, 41932, 41934, 41935, 41936, 41937, 41940, 41941, 41950, 41952, 41953, 41954, 41956, 41957, 41962, 41964, 41965, 41970, 41975, 41976, 41977, 41978, 41982, 41983, 41984, 41989, 41993, 41994, 41995, 41997, 41999, 42000, 42001, 42003, 42007, 42013, 42102, 42236, 42262, 42362, 42364, 42393, 42404

ATTACK RATES
42106

AUSTRALASIA
41297, 41386, 41408, 41940, 41959, 41963, 42016, 42047, 42296, 42301, 42397

AUSTRALIA
41297, 41386, 41408, 41940, 41959, 41963, 42016, 42047, 42296, 42301, 42397

AUTOMATIC MEASUREMENT METHODS
41700, 41739, 41760, 41889

AUTOMOBILES
41194, 41211, 41214, 41225, 41229, 41230, 41243, 41248, 41259, 41281, 41283, 41323, 41353, 41355, 41356, 41366, 41405, 41430, 41449, 41461, 41462, 41463, 41464, 41465, 41466, 41468, 41474, 41492, 41504, 41511, 41512, 41525, 41535, 41542, 41565, 41582, 41593, 41599, 41601, 41630, 41648, 41669, 41722, 41770, 41854, 41862, 41871, 41883, 41887, 42000, 42058, 42320, 42321, 42322, 42326, 42332, 42370, 42382, 42386, 42391, 42403

AUTOMOTIVE EMISSION CONTROL
41194, 41214, 41218, 41229, 41236, 41237, 41238, 41248, 41259, 41262, 41264, 41268, 41274, 41283, 41284, 41301, 41305, 41315, 41323, 41347, 41355, 41356, 41376, 41386, 41396, 41400, 41402, 41405, 41414, 41421, 41430, 41440, 41442, 41448, 41449, 41451, 41462, 41463, 41464, 41465, 41466, 41468, 41473, 41474, 41487, 41492, 41494, 41507, 41511, 41525, 41533, 41536, 41541, 41542, 41550, 41556, 41569, 41573, 41590, 41593, 41599, 41601, 41610, 41612, 41614, 41616, 41621, 41626, 41628, 41629, 41641, 41642, 41643, 41648, 41654, 41669, 41672, 41780, 41895, 42066, 42320, 42326, 42329, 42375, 42377, 42382, 42386

B

BACTERIA
41980, 41989, 41992, 42009, 42204

BAFFLES
41425, 41586

BAG FILTERS
41247, 41351, 41412, 41470, 41477, 41545, 41635

BALLOONS
42364

BASIC OXYGEN FURNACES
41270

BATTERY MANUFACTURING
42168, 42189, 42238

BELGIUM
41744, 41761, 41773, 41900, 42223, 42403

BENZENE-SOLUBLE ORGANIC MATTER
41202, 41927, 42143

BENZENES
41202, 41770, 41869, 42174, 42313

BENZO(3-4)PYRENE
41863, 41906, 42279

BENZOPYRENES
41202, 41863, 41906, 42279

BERYLLIUM COMPOUNDS
42366

BETA PARTICLES
41828

BIO-ASSAY
41820, 42143, 42271

BIOCHEMISTRY
41527, 42068, 42099, 42120, 42131, 42159, 42168, 42173, 42192, 42194, 42266, 42267

BIOCLIMATOLOGY
42167, 42200, 42201, 42277

BIOLOGICAL FACTORS
41527, 42068, 42099, 42120, 42131, 42159, 42168, 42173, 42192, 42194, 42266, 42267

BIRDS
42253

BLAST FURNACE AND BASIC STEEL PRODUCTS M
41270, 41277, 41335, 41434, 41524, 41620

BLAST FURNACES
41277, 41524, 41620

BLOOD CELLS
42100, 42103, 42117, 42120, 42126, 42151, 42173, 42185, 42187, 42188, 42191, 42208, 42223

BLOOD CHEMISTRY
42104, 42105, 42117, 42120, 42129, 42146, 42151, 42174, 42177, 42188, 42191, 42194, 42203

BLOOD GAS ANALYSIS
42116, 42132

BLOOD PRESSURE
42097, 42155

BLOWBY
41512

BODIES OF WATER
41200, 41852, 41860, 41927, 41938, 41948, 41950, 41960, 41985, 41990, 41996, 42256

BODY FLUIDS
41828, 42205

BOILERS
41196, 41204, 41208, 41213, 41310, 41332, 41352, 41371, 41382, 41394, 41455, 41467, 41486, 41521, 41562, 41578, 41581, 41587, 41589, 41598, 41608, 41624, 41662, 41664, 41679, 41719, 41721, 41742, 41743, 41808, 42305, 42313, 42318, 42366, 42379

BONES
42118, 42174, 42187, 42188, 42208

BREATHING
42110, 42153, 42169, 42174

BREATHING APPARATUS
42166

BRICKS
41351

BROMIDES
42022

BROMINE
41855

BROMINE COMPOUNDS
42022

BRONCHI
42103, 42125, 42140, 42145, 42253

BRONCHIAL CANCER
42179

BRONCHITIS
41231, 42121, 42132, 42140, 42142, 42154, 42167, 42179, 42180, 42182, 42403

BRONCHOCONSTRICTION
42154

BRONCHODILATORS
42176

BROWNIAN MOTION
41458

BUBBLE CAP TOWERS
41432, 41633, 41728

BUILD-UP RATES
41960

BUILDINGS
41378, 41893, 41962, 41977, 42210, 42219, 42224, 42240, 42244

BURNING
41287, 41509, 41868, 42356, 42357

BUSES
41262, 41264, 41338, 41366, 42391

BUTADIENES
42054

BUTANES
42061

BUTENES
41760, 42054

BUTYRALDEHYDES
42127

BY-PRODUCT RECOVERY
41210, 41292, 41295, 41296, 41299, 41302, 41303, 41306, 41307, 41308, 41310, 41312, 41316, 41320, 41331, 41332, 41336, 41339, 41340, 41344, 41345, 41352, 41360, 41361, 41362, 41367, 41374, 41377, 41382, 41387, 41388, 41389, 41391, 41394, 41403, 41408, 41409, 41410, 41417, 41426, 41427, 41431, 41433, 41435, 41436, 41445, 41450, 41455, 41456, 41471, 41480, 41482, 41484, 41490, 41496, 41502, 41503, 41505, 41506, 41515, 41518, 41520, 41521, 41522, 41527, 41528, 41529, 41531, 41553, 41561, 41575, 41578, 41585, 41595, 41608, 41638, 41656, 41658, 41659, 41671, 41677, 42224, 42294, 42303

BYSSINOSIS
42176

C

CADMIUM COMPOUNDS
41243, 41756, 41891, 41898, 41904, 42114, 42238, 42260, 42264, 42271, 42392

CALCIUM COMPOUNDS
41254, 41307, 41308, 41320, 41360, 41413, 41548, 41587, 41855, 41883, 41997, 42057, 42191, 42198, 42243, 42286

CALCIUM SULFATES
41307, 41360, 41587

CALIBRATION METHODS
41703, 41707, 41741, 41748, 41757, 41774, 41779, 41786, 41787, 41792, 41798, 41801, 41810, 41822, 41831, 42166

CALIFORNIA
41855, 41864, 41880, 41882, 41924, 41930, 41954, 42062, 42143, 42210, 42272, 42329, 42349, 42376, 42385, 42402

CANADA
41235, 41314, 41490, 41549, 41695, 41772, 41791, 41925, 41932, 41947, 41984, 42015, 42029, 42040, 42092, 42186, 42245, 42259, 42262, 42271, 42387

CANCER
42092, 42109, 42112, 42140, 42154, 42179, 42182, 42183, 42186, 42193, 42201, 42205

CARBON
41294, 41308, 41311, 41383, 41426, 41453, 41531, 41552, 41558, 41578, 41600, 41609, 41618, 41637, 41670, 41673, 41706, 42031, 42039, 42050, 42205, 42253, 42282, 42284

CARBON BLACK
41308, 41311, 41383, 41426, 41453, 41531, 41552, 41558, 41600, 41609, 41618, 41637, 41670, 41673, 41706, 42031, 42039, 42050, 42205, 42253, 42282, 42284

CARBON DIOXIDE
41193, 41194, 41240, 41310, 41338, 41405, 41438, 41464, 41489, 41527, 41670, 41698, 41700, 41704, 41730, 41751, 41763, 41782, 41788, 41794, 41808, 41813, 41814, 41815, 41839, 41883, 41914, 41953, 41960, 41973, 41986, 41990, 41993, 42000, 42033, 42067, 42141, 42242, 42400

CARBON DISULFIDE
41336, 41534, 41760

CARBON MONOXIDE
41193, 41194, 41196, 41197, 41201, 41205, 41211, 41218, 41220, 41225, 41227, 41228, 41229, 41230, 41234, 41236, 41237, 41240, 41245, 41248, 41252, 41255, 41257, 41262, 41269, 41270, 41274, 41290, 41322, 41338, 41353, 41355, 41356, 41371, 41372, 41380, 41396, 41400, 41405, 41420, 41421, 41422, 41449, 41451, 41463, 41464, 41465, 41466, 41468, 41473, 41483, 41492, 41494, 41504, 41525, 41537, 41551, 41560, 41565, 41566, 41568, 41569, 41576, 41593, 41601, 41607, 41612, 41628, 41630, 41632, 41648, 41667, 41670, 41700, 41702, 41704, 41710, 41712, 41722, 41725, 41739, 41742, 41763, 41773, 41774, 41779, 41780, 41788, 41794, 41795, 41796, 41799, 41800, 41801, 41808, 41813, 41814, 41816, 41827, 41848, 41861, 41862, 41864, 41875, 41877, 41882, 41883, 41884, 41886, 41887, 41888, 41889, 41890, 41893, 41899, 41905, 41906, 41937, 41943, 41944, 41960, 41965, 41966, 41980, 41984, 42000, 42037, 42039, 42041, 42050, 42054, 42059, 42067, 42072, 42073, 42092, 42093, 42102, 42117, 42130, 42135, 42136, 42150, 42153, 42154, 42155, 42156, 42159, 42160, 42164, 42169, 42181, 42182, 42183, 42314, 42316, 42320, 42321, 42323, 42324, 42326, 42341, 42364, 42366, 42367, 42375, 42380, 42382, 42385, 42400, 42402

CARBONATES
41254, 41320, 41529, 41548, 41553, 41587, 41596, 41670, 42057, 42285

CARBONYLS
41336, 41534

CARBOXYHEMOGLOBIN
41607, 42102, 42117, 42130, 42150, 42153, 42155, 42156, 42164, 42181

CARBURETION
41248, 41466, 41542, 41593

CARCINOGENS
41205, 41820, 42109, 42143, 42145, 42179, 42193, 42205

CARDIOVASCULAR DISEASES
41607, 42095, 42147, 42150, 42155, 42158, 42180, 42189, 42201

CASCADE IMPACTORS
41765, 41841, 41845, 41847, 41858, 42022

CATALYSIS
41291, 41299, 41305, 41314, 41325, 41332, 41344, 41353, 41354, 41368, 41372, 41376, 41381, 41394, 41401, 41402, 41406, 41433, 41461, 41462, 41471, 41481, 41485, 41508, 41515, 41533, 41545, 41563, 41568, 41603, 41611, 41613, 41630, 41631, 41638, 41654, 41673, 41675, 42037, 42039, 42050, 42052, 42053, 42060, 42067, 42069, 42072, 42079, 42313

CATALYSTS
41291, 41305, 41314, 41325, 41344, 41354, 41368, 41376, 41381, 41394, 41401, 41402, 41406, 41461, 41471, 41508, 41515, 41533, 41568, 41603, 41611, 41630, 41631, 41638, 41654, 41673, 41675, 42037, 42052, 42060, 42067, 42072, 42079, 42313

CATALYTIC ACTIVITY
41305, 41353, 41354, 41372, 41376, 41402, 41406, 41461, 41462, 41481, 41545, 41568, 41630, 41631, 42050, 42052, 42053, 42060, 42067, 42069, 42072, 42079

CATALYTIC AFTERBURNERS
41234, 41274, 41305, 41309, 41323, 41336, 41340, 41372, 41376, 41402, 41441, 41449, 41461, 41462, 41483, 41494, 41507, 41533, 41556, 41565, 41566, 41568, 41654, 42067, 42320, 42326, 42403

CATALYTIC OXIDATION
41231, 41237, 41291, 41308, 41311, 41320, 41325, 41332, 41353, 41372, 41389, 41449, 41502, 41504, 41521, 41531, 41545, 41565, 41568, 41618, 41630, 41631, 41638, 41654, 41673, 41675, 41677, 42053, 42305

CATS
42141

CATTLE
42215, 42223, 42278

CELL GROWTH
42100, 42128, 42159, 42276, 42278

CELL METABOLISM
41319, 42100, 42113, 42122, 42131, 42140, 42145, 42161, 42217, 42278

CELLS (BIOLOGY)
42094, 42100, 42103, 42117, 42120, 42122, 42124, 42125, 42126, 42136, 42143, 42151, 42159, 42165, 42173, 42185, 42187, 42188, 42191, 42204, 42208, 42216, 42218, 42223, 42225, 42252

CEMENTS
41296, 41339, 41377, 41388, 41408, 41488, 41659

CENTRAL AMERICA
41860

CENTRIFUGAL SEPARATORS
41209, 41253, 41288, 41329, 41337, 41390, 41416, 41425, 41429, 41460, 41467, 41493, 41520, 41545, 41547, 41548, 41578, 41579, 41586, 41635, 41639, 41839, 41841

CERAMICS
41351, 41454, 42151

CERIUM COMPOUNDS
41556

CHARCOAL
41294, 41558, 41578

CHEMICAL BONDS
42025, 42046

CHEMICAL COMPOSITION
41202, 41204, 41272, 41273, 41338, 41408, 41409, 41410, 41417, 41444, 41595, 41697, 41703, 41716, 41735, 41736, 41742, 41743, 41745, 41776, 41819, 41841, 41845, 41850, 41851, 41854, 41856, 41858, 41859, 41860, 41863, 41868, 41874, 41877, 41878, 41882, 41883, 41891, 41892, 41894, 41897, 41898, 41904, 41906, 41927, 41954, 41971, 41997, 42012, 42018, 42062, 42143, 42171, 42181, 42258, 42292, 42385

CHEMICAL METHODS
41387, 41694, 41695, 41709, 41710, 41717, 41725, 41726, 41741, 41742, 41743, 41771, 41773, 41798, 41805, 41813, 41857, 41889, 41905, 42326

CHEMICAL PROCESSING
41195, 41213, 41224, 41231, 41232, 41278, 41280, 41365, 41383, 41427, 41434, 41502, 41508, 41516, 41522, 41527, 41554, 41563, 41571, 41588, 41613, 41904, 42262, 42295, 42303, 42313, 42331

CHEMICALS AND ALLIED MANUFACTURING
41231, 41235, 41406, 41416, 41545, 41671, 41680, 41904, 42238, 42388

CHICAGO
41897, 42382

CHLORATES
42257

CHLORIDES
41392, 41450, 41584, 41847, 41865, 41883, 41911, 42005, 42255, 42271, 42273, 42282, 42285, 42292

CHLORINATED HYDROCARBONS
41195, 41282, 41820, 41822, 41927, 41938, 41996, 42109, 42123, 42170, 42178

CHLORINE
41571, 41595, 41666, 41862, 42262

CHLORINE COMPOUNDS
41392, 41450, 41539, 41584, 41700, 41712, 41723, 41760, 41847, 41865, 41883, 41911, 42005, 42255, 42257, 42271, 42273, 42282, 42283, 42285, 42292

CHLOROPLASTS
42225, 42227, 42237, 42252, 42275

CHLOROSIS
42214, 42226, 42233, 42234, 42235, 42240, 42249

CHROMATOGRAPHY
41202, 41219, 41278, 41397, 41699, 41704, 41712, 41722, 41723, 41725, 41729, 41740, 41743, 41760, 41767, 41768, 41769, 41770, 41800, 41802, 41811, 41813, 41814, 41820, 41830, 41885, 41927, 42018

CHROMIUM
41353, 41372, 41565, 42067

CHROMIUM COMPOUNDS
42171, 42285

CHROMOSOMES
42223

CILIA
42103, 42204

CINDERS
41303

CIRCULATORY SYSTEM
41607, 42159, 42164, 42183

CITY GOVERNMENTS
41287

CLAY
41381

CLEAN AIR ACT
41492, 42300, 42316, 42326, 42327, 42331, 42367

CLOUD SEEDING
41971, 41988

CLOUDS
41782, 41790, 41929, 41939, 41966, 41974, 41985, 41986, 42002, 42004, 42011, 42012

CLOVER
42277

COAL
41215, 41222, 41239, 41244, 41254, 41258, 41272, 41273, 41304, 41306, 41308, 41316, 41332, 41360, 41367, 41373, 41385, 41388, 41391, 41408, 41431, 41433, 41434, 41435, 41438, 41455, 41480, 41491, 41506, 41578, 41595, 41662, 41707, 41719, 41756, 41764, 41853, 41883, 41932, 41990, 42057, 42145, 42243, 42306, 42313, 42379

COAL CONVERSION
41196, 41297, 41304, 41332, 41340, 41367, 41393, 41415, 41423, 41438, 41462, 41506, 41537, 41576, 41591, 41604, 42293, 42405

COAL PREPARATION
41265, 41360, 41427

COBALT COMPOUNDS
42146, 42175

CODES
42325

COKE
41204, 41215, 41232, 41289, 41427, 41434, 41479, 41529, 41763, 42350

COLLECTORS (MECHANICAL)
41198, 41209, 41247, 41249, 41253, 41288, 41329, 41332, 41337, 41363, 41390, 41404, 41411, 41416, 41425, 41429, 41460, 41467, 41470, 41493, 41499, 41520, 41545, 41547, 41548, 41562, 41578, 41579, 41586, 41613, 41619, 41620, 41622, 41635, 41639, 41686, 41687, 41839, 41841, 41853, 41877, 41878, 42029

COLLOIDS
42008

COLORADO
41205, 41871, 42345

COLORIMETRY
41701, 41742, 41743, 41759, 41760, 41766, 41768, 41773, 41777, 41805, 41889, 42403

COLUMN CHROMATOGRAPHY
41767

COMBUSTION
41203, 41236, 41263, 41288, 41385, 41451, 41493, 41536, 41560, 41748, 42014, 42027, 42028, 42057

COMBUSTION AIR
41206, 41208, 41217, 41226, 41236, 41247, 41286, 41289, 41361, 41371, 41385, 41449, 41452, 41478, 41486, 41494, 41497, 41511, 41560, 41581, 41742, 42045, 42403

COMBUSTION PRODUCTS
41198, 41205, 41223, 41244, 41254, 41256, 41265, 41272, 41273, 41288, 41303, 41306, 41380, 41467, 41532, 41554, 41581, 41595, 41656, 41794, 41950, 41960, 41973, 42028, 42150, 42243, 42264, 42306

COMMERCIAL EQUIPMENT
41443, 41474, 41484, 41497, 41561, 41704, 41712

COMMERCIAL FIRMS
41470, 41474, 42333

COMPLAINTS
42115

COMPLIANCE (RESPIRATORY)
41719, 42120, 42310, 42338, 42342, 42343, 42347, 42348, 42353, 42355, 42358, 42359, 42366, 42367

COMPOSTING
41343

COMPRESSION
41404

COMPUTER PROGRAMS
41346, 41544, 41731, 41776, 41886, 41955, 41958, 42018, 42305, 42324, 42339

COMPUTERS
41208, 41269, 41650, 41691, 41700, 41731, 41773, 41889, 41969, 41977, 42016, 42339, 42352, 42396

CONCRETE
41247, 41331, 41377, 41388, 41408, 41417, 41456, 42294

CONDENSATION
41209, 41245, 41357, 41404, 41502, 41529, 41579, 41629, 42017, 42080, 42091

CONDENSATION (ATMOSPHERIC)
41221, 41249, 41570, 41782, 41790, 41832, 41845, 41876, 41882, 41909, 41919, 41929, 41939, 41966, 41974, 41985, 41986, 41992, 42002, 42004, 42006, 42009, 42011, 42012, 42013, 42083, 42167

CONSTRUCTION MATERIALS
41198, 41247, 41296, 41303, 41307, 41331, 41339, 41351, 41374, 41377, 41388, 41391, 41392, 41408, 41417, 41424, 41436, 41454, 41456, 41480, 41488, 41659, 41664, 42286, 42294

CONTINUOUS MONITORING
41704, 41722, 41738, 41763, 41788, 41793, 41835, 41882, 41886, 42092, 42254, 42364

CONTRACTING
42366

CONTROL AGENCIES
42330, 42332, 42333, 42365, 42376, 42381, 42388

CONTROL EQUIPMENT-GAS STREAMS
41198, 41209, 41231, 41234, 41244, 41247, 41249, 41253, 41254, 41262, 41270, 41274, 41277, 41279, 41288, 41291, 41294, 41297, 41300, 41305, 41307, 41308, 41309, 41311, 41312, 41313, 41315, 41320, 41323, 41325, 41326, 41328, 41329, 41330, 41332, 41333, 41335, 41336, 41337, 41340, 41342, 41343, 41348, 41351, 41354, 41357, 41358, 41359, 41362, 41363, 41364, 41370, 41372, 41375, 41376, 41378, 41379, 41381, 41383, 41384, 41387, 41390, 41391, 41392, 41402, 41404, 41407, 41411, 41412, 41416, 41418, 41419, 41424, 41425, 41426, 41428, 41429, 41432, 41433, 41439, 41441, 41444, 41445, 41446, 41447, 41449, 41450, 41454, 41458, 41459, 41460, 41461, 41462, 41464, 41466, 41467, 41469, 41470, 41475, 41477, 41478, 41479, 41483, 41484, 41485, 41489, 41492, 41493, 41494, 41499, 41500, 41501, 41503, 41506, 41507, 41510, 41511, 41512, 41513, 41514, 41517, 41518, 41519, 41520, 41524, 41530, 41532, 41533, 41534, 41538, 41539, 41543, 41545, 41546, 41547, 41548, 41552, 41553, 41555, 41556, 41557, 41561, 41562, 41563, 41565, 41566, 41567, 41568, 41571, 41572, 41575, 41577, 41578, 41579, 41580, 41584, 41585, 41586, 41597, 41598, 41599, 41604, 41605, 41609, 41612, 41613, 41615, 41617, 41619, 41620, 41622, 41623, 41624, 41625, 41627, 41628, 41633, 41635, 41636, 41639, 41640, 41641, 41644, 41645, 41646, 41647, 41649, 41650, 41651, 41653, 41654, 41655, 41657, 41662, 41663, 41664, 41665, 41666, 41667, 41668, 41673, 41674, 41676, 41679, 41680, 41681, 41682, 41683, 41684, 41685, 41686, 41687, 41688, 41713, 41714, 41728, 41735, 41744, 41753, 41754, 41765, 41784, 41815, 41818, 41838, 41839, 41841, 41853, 41865, 41877, 41878, 42029, 42047, 42067, 42077, 42135, 42207, 42221, 42281, 42305, 42311, 42320, 42326, 42360, 42403

CONTROL PROGRAMS
41259, 41283, 41302, 41470, 41554, 41604, 42302, 42313, 42315, 42318, 42320, 42323, 42328, 42329, 42333, 42334, 42335, 42337, 42338, 42339, 42342, 42343, 42344, 42345, 42346, 42350, 42352, 42353, 42354, 42356, 42357, 42358, 42361, 42365, 42366, 42367, 42370, 42371, 42375, 42376, 42382, 42383, 42386, 42388, 42396, 42399, 42401, 42402, 42405

CONTROLLED ATMOSPHERES
41786, 42111, 42210

CONVECTION (ATMOSPHERIC)
41941, 41975

COOLING
41198, 41221, 41404, 41570, 41689, 41705, 42085

COOLING TOWERS
41221, 41239, 41249, 41570, 41915, 42254

COPPER
41345, 41372, 41406, 41434, 41439, 41483, 41490, 41565, 41566, 41654, 41894, 42037, 42060, 42067

COPPER ALLOYS
41439, 41654

COPPER COMPOUNDS
41243, 41496, 41540, 41574, 41670, 41716, 41891, 41898, 41904, 42163, 42260, 42264

CORN
42224, 42235, 42244

CORONA
42047

CORROSION
41352, 41392, 41405, 41514, 41529, 41532, 41562, 41627, 42280, 42281, 42282, 42283, 42284, 42285, 42288, 42289, 42290, 42291, 42292, 42403

COSTS
41195, 41201, 41234, 41246, 41299, 41310, 41311, 41314, 41315, 41324, 41327, 41328, 41332, 41334, 41342, 41344, 41352, 41363, 41366, 41383, 41386, 41389, 41400, 41411, 41450, 41461, 41467, 41477, 41482, 41486, 41492, 41496, 41499, 41502, 41505, 41510, 41520, 41521, 41529, 41531, 41534, 41535, 41554, 41562, 41563, 41567, 41570, 41572, 41576, 41578, 41591, 41598, 41604, 41613, 41627, 41631, 41642, 42064, 42173, 42293, 42296, 42297, 42298, 42299, 42300, 42301, 42302, 42303, 42304, 42305, 42306, 42307, 42308, 42309, 42310, 42311, 42313, 42316, 42337, 42339, 42366, 42374, 42391, 42401, 42402

COTTON
42107, 42119, 42210

COUGH
42133

CRANKCASE EMISSIONS
41512, 41555, 41648

CRANKCASE VENTILATION AIR
41555

CRITERIA
41447, 41468, 41554, 41719, 42074, 42105, 42127, 42168, 42322, 42362, 42366, 42369, 42381

CROP SERVICES
41925

CROP SPRAYING
41925

CROPS
41579, 41898, 42107, 42119, 42176, 42210, 42211, 42219, 42220, 42223, 42224, 42228, 42235, 42238, 42242, 42244, 42245, 42252, 42263, 42264, 42265, 42266, 42267, 42268, 42269, 42270, 42277, 42279

CRYSTAL STRUCTURE
41433, 42080

CUMULATIVE MEASUREMENT METHODS
41823

CUPOLAS
41193, 41[illegible]39, 41444

CYANATES
41529

CYANIDES
41277, 41317, 41471, 41729, 41785, 41862, 41964, 42402

CYCLIC ALKANES
41770, 42032, 42059, 42190

CYCLONES (ATMOSPHERIC)
41875

CZECHOSLOVAKIA
41223, 41270, 41566, 41587, 41664, 41681, 41682, 41683, 41686, 41687, 41689, 41833, 41841, 41843, 41845, 41847, 41863, 41912, 42011, 42012, 42013, 42090, 42166, 42191, 42278, 42311

D

DATA ANALYSIS
41731, 41739, 41763, 41807, 41886, 42305, 42324, 42364

DATA HANDLING SYSTEMS
41346, 41544, 41691, 41700, 41731, 41739, 41760, 41763, 41776, 41799, 41807, 41835, 41886, 41914, 41955, 41958, 41987, 41988, 42018, 42305, 42324, 42337, 42339, 42351, 42352, 42364, 42369, 42372, 42384, 42396

DECISIONS
42389

DECOMPOSITION
41423, 41441, 41811, 42039, 42041, 42043, 42050, 42060, 42079, 42313

DENMARK
41607, 42246

DENSITY
41374, 41724, 41790, 41928, 42019

DEPOSITION
41217, 41224, 41407, 41562, 41655, 41684, 41691, 41703, 41724, 41917, 41933, 41938, 41942, 41972, 41982, 41983, 42016, 42021, 42070, 42071, 42090, 42103, 42145, 42148, 42204, 42207, 42223, 42253, 42256, 42258, 42260, 42277

DIAGNOSIS
41820, 42099, 42116, 42132, 42142, 42143, 42152, 42173, 42174, 42184, 42185, 42192, 42194, 42199, 42202, 42215, 42218, 42271

DIESEL ENGINES
41202, 41203, 41217, 41227, 41228, 41237, 41257, 41261, 41262, 41264, 41268, 41283, 41290, 41400, 41421, 41422, 41448, 41463, 41582, 41601, 41608, 41610, 41761, 41803, 42018, 42326, 42357

DIFFRACTION
41433, 41713, 42286

DIFFUSION
41200, 41276, 41285, 41458, 41655, 41724, 41840, 41847, 41851, 41872, 41883, 41903, 41909, 41910, 41916, 41924, 41925, 41933, 41942, 41945, 41965, 41970, 41977, 41989, 41990, 41995, 41999, 42011, 42033, 42049, 42066, 42071, 42083, 42088, 42169, 42247, 42262, 42264

DIFFUSION (ATMOSPHERIC)
41633, 41804, 41914, 41915, 41917, 41932, 41934, 41948, 41952, 41957, 41958, 41959, 41960, 41961, 41963, 41968, 41969, 41972, 41975, 41976, 41981, 41984, 41991, 42007, 42011, 42012, 42071, 42305, 42344, 42375

DIFFUSION MODELS
41633, 41804, 41914, 41915, 41917, 41932, 41934, 41948, 41952, 41957, 41958, 41959, 41960, 41961, 41963, 41968, 41969, 41972, 41975, 41976, 41981, 41984, 41991, 42007, 42011, 42012, 42071, 42305, 42344, 42375

DIGESTERS
41674

DIGESTIVE SYSTEM
41231, 42118, 42146, 42187, 42188, 42208, 42278

DIGITAL METHODS
41763

DIOLEFINS
42054

DIPHENYLS
41758, 41927

DISCOLORATION
42403

DISPERSIONS
41465, 42008

DISSIPATION RATES
41960

DISTILLATE OILS
41462, 42377

DOGS
42124, 42169, 42181, 42208

DOMESTIC HEATING
41302, 41361, 41362, 41373, 41462, 41575, 41839, 41893, 41909, 42179, 42201

DROPLETS
41247, 41249, 41647, 41676, 41845, 41925, 42044, 42085, 42087, 42088

DRUGS
41820, 42097, 42106, 42176, 42191, 42198, 42202, 42203

DRYING
41209, 41520, 41586, 41678, 42312, 42379

DUMPS
41316

DUST FALL
41224, 41243, 41691, 41761, 41896, 41994, 42256

DUSTS
41193, 41195, 41202, 41205, 41222, 41223, 41225, 41231, 41239, 41247, 41253, 41255, 41270, 41271, 41281, 41289, 41321, 41329, 41330, 41349, 41358, 41363, 41370, 41378, 41382, 41404, 41411, 41416, 41429, 41439, 41444, 41454, 41460, 41462, 41470, 41493, 41500, 41506, 41538, 41539, 41543, 41545, 41547, 41571, 41578, 41598, 41600, 41619, 41620, 41622, 41624, 41627, 41635, 41639, 41645, 41657, 41662, 41663, 41681, 41684, 41686, 41687, 41688, 41691, 41707, 41713, 41714, 41727, 41736, 41738, 41739, 41742, 41743, 41745, 41754, 41765, 41766, 41784, 41786, 41789, 41818, 41824, 41842, 41850, 41853, 41856, 41859, 41863, 41872, 41877, 41878, 41879, 41881, 41883, 41891, 41898, 41906, 41964, 41986, 41990, 41995, 42005, 42015, 42090, 42093, 42104, 42105, 42106, 42107, 42112, 42119, 42135, 42136, 42137, 42145, 42172, 42176, 42180, 42184, 42199, 42205, 42221, 42222, 42236, 42253, 42258, 42279, 42282, 42311, 42312, 42364, 42379, 42392, 42398

DYNAMOMETERS
41227, 41228, 41229, 41230, 41237, 41353, 41356, 41376, 41449, 41474, 41722, 41803

E

ECONOMIC LOSSES
41246, 42296, 42299, 42306, 42307, 42308

ECONOMICS
41195, 41201, 41234, 41246, 41299, 41310, 41311, 41314, 41315, 41324, 41327, 41328, 41332, 41334, 41342, 41344, 41352, 41363, 41366, 41383, 41386, 41389, 41400, 41411, 41450, 41461, 41467, 41477, 41482, 41486, 41492, 41496, 41499, 41502, 41505, 41510, 41520, 41521, 41529, 41531, 41534, 41535, 41554, 41562, 41563, 41567, 41570, 41572, 41576, 41578, 41591, 41598, 41604, 41613, 41627, 41631, 41642, 42064, 42173, 42293, 42296, 42297, 42298, 42299, 42300, 42301, 42302, 42303, 42304, 42305, 42306, 42307, 42308, 42309, 42310, 42311, 42313, 42316, 42337, 42339, 42366, 42374, 42391, 42401, 42402

EDUCATION
41688, 42336, 42340

EFFICIENCY
41211, 41250, 41254, 41256, 41288, 41291, 41294, 41297, 41308, 41311, 41314, 41315, 41328, 41329, 41332, 41333, 41354, 41357, 41359, 41361, 41363, 41370, 41376, 41384, 41385, 41386, 41387, 41389, 41411, 41416, 41426, 41429, 41432, 41439, 41444, 41453, 41454, 41458, 41459, 41461, 41464, 41465, 41477, 41487, 41499, 41501, 41503, 41510, 41531, 41538, 41540, 41544, 41548, 41558, 41559, 41565, 41568, 41572, 41577, 41578, 41585, 41589, 41591, 41604, 41622, 41624, 41635, 41638, 41639, 41642, 41647, 41649, 41657, 41660, 41662, 41664, 41667, 41677, 41679, 41681, 41682, 41684, 41686, 41687, 41688, 41692, 41693, 41694, 41695, 41698, 41699, 41701, 41702, 41706, 41709, 41715, 41726, 41728, 41734, 41740, 41746, 41748, 41753, 41758, 41759, 41765, 41766, 41771, 41774, 41776, 41777, 41790, 41793, 41798, 41801, 41802, 41805, 41810, 41821, 41824, 41826, 41834, 41838, 41846, 41865, 42002, 42007, 42071, 42078, 42311

ELECTRIC BATTERIES
41274, 41290, 41669

ELECTRIC FURNACES
41193, 41445, 41470, 41877

ELECTRIC POWER GENERATION
41199, 41206, 41207, 41213, 41215, 41221, 41222, 41234, 41239, 41244, 41249, 41252, 41254, 41258, 41260, 41265, 41273, 41302, 41303, 41306, 41308, 41316, 41319, 41332, 41361, 41367, 41371, 41373, 41374, 41382, 41388, 41389, 41391, 41392, 41403, 41409, 41418, 41433, 41435, 41438, 41462, 41469, 41472, 41480, 41505, 41516, 41522, 41553, 41562, 41567, 41570, 41578, 41581, 41595, 41598, 41604, 41626, 41627, 41659, 41662, 41664, 41764, 41853, 41909, 41932, 41933, 41955, 41957, 42293, 42294, 42298, 42305, 42306, 42373, 42376, 42377

ELECTRIC POWER SOURCES
41274, 41290, 41346, 41386, 41462, 41601, 41610, 41626, 41669, 42293

ELECTRIC, GAS, AND SANITARY SERVICES
41198, 41199, 41206, 41207, 41213, 41215, 41221, 41222, 41234, 41235, 41239, 41244, 41249, 41252, 41253, 41254, 41256, 41258, 41260, 41263, 41265, 41271, 41273, 41282, 41287, 41295, 41298, 41302, 41303, 41306, 41308, 41312, 41316, 41319, 41326, 41327, 41332, 41341, 41343, 41345, 41361, 41367, 41371, 41373, 41374, 41382, 41383, 41388, 41389, 41391, 41392, 41403, 41406, 41409, 41410, 41415, 41416, 41418, 41425, 41426, 41433, 41435, 41438, 41452, 41462, 41467, 41469, 41472, 41480, 41497, 41499, 41505, 41506, 41509, 41516, 41518, 41522, 41528, 41534, 41553, 41562, 41563, 41567, 41570, 41571, 41578, 41581, 41585, 41594, 41595, 41598, 41604, 41605, 41615, 41617, 41626, 41627, 41658, 41659, 41662, 41664, 41667, 41742, 41743, 41764, 41815, 41830, 41853, 41855, 41909, 41932, 41933, 41955, 41957, 42281, 42293, 42294, 42298, 42301, 42305, 42306, 42325, 42373, 42376, 42377, 42379, 42391

ELECTRICAL AND ELECTRONIC EQUIPMENT PLAN
42168, 42189, 42238

ELECTRICAL PROPERTIES
41390, 41419, 41549, 41627, 41684, 41724, 41757, 41883, 41967, 41974, 42047, 42051, 42276

ELECTRICAL RESISTANCE
41627, 42047

ELECTRICITY (ATMOSPHERIC)
41912, 41928, 41974

ELECTROCHEMICAL METHODS
41387, 41695, 41710, 41717, 41725, 41726, 41743, 41813

ELECTROCONDUCTIVITY ANALYZERS
41710, 41712, 41742, 41743, 41754, 41889, 41905, 42288

ELECTROLYSIS
41547, 41576, 41725

ELECTRON MICROSCOPY
41764, 41819, 41841, 41971, 42152, 42172, 42225, 42252

ELECTROSTATIC COUNTERS
41967

ELECTROSTATIC PRECIPITATORS
41198, 41244, 41253, 41351, 41363, 41375, 41378, 41407, 41411, 41418, 41419, 41426, 41429, 41444, 41469, 41499, 41532, 41545, 41571, 41577, 41578, 41597, 41598, 41604, 41627, 41639, 41662, 41682, 41683, 41684, 41686, 41688, 41841, 42047, 42207

EMISSION INVENTORIES
41206, 41207, 41216, 41866, 41984, 42375

EMISSION STANDARDS
41248, 41254, 41259, 41264, 41323, 41463, 41465, 41466, 41468, 41473, 41492, 41497, 41504, 41535, 41554, 41610, 41612, 41652, 41803, 42312, 42313, 42314, 42316, 42317, 42318, 42319, 42320, 42321, 42322, 42325, 42326, 42328, 42332, 42335, 42338, 42342, 42343, 42345, 42350, 42353, 42354, 42355, 42358, 42361, 42366, 42377, 42381, 42382, 42398

EMPHYSEMA
42137, 42145, 42154, 42160, 42179, 42180, 42182, 42183, 42392

EMULSIONS
41465

ENFORCEMENT PROCEDURES
42346, 42367, 42373, 42389

ENGINE DESIGN MODIFICATION
41194, 41274, 41301, 41400, 41463, 41466, 41473, 41474, 41487, 41492, 41536, 41590, 41601, 41610, 41621, 41642, 41643, 41669, 42066, 42326

ENGINE EMISSIONS
41194, 41197, 41201, 41202, 41203, 41211, 41214, 41217, 41218, 41219, 41220, 41227, 41228, 41229, 41230, 41234, 41236, 41237, 41241, 41242, 41245, 41248, 41252, 41257, 41259, 41261, 41262, 41264, 41266, 41267, 41268, 41269, 41274, 41276, 41283, 41284, 41290, 41301, 41305, 41309, 41313, 41315, 41322, 41323, 41338, 41340, 41347, 41353, 41355, 41356, 41358, 41366, 41368, 41372, 41379, 41396, 41400, 41405, 41414, 41420, 41421, 41422, 41430, 41440, 41441, 41442, 41448, 41449, 41451, 41461, 41462, 41463, 41464, 41465, 41466, 41468, 41473, 41474, 41478, 41483, 41486, 41487, 41492, 41494, 41499, 41504, 41507, 41511, 41512, 41525, 41530, 41533, 41535, 41536, 41541, 41542, 41550, 41551, 41555, 41556, 41557, 41560, 41565, 41566, 41568, 41569, 41573, 41580, 41582, 41590, 41593, 41599, 41601, 41608, 41609, 41610, 41612, 41614, 41616, 41621, 41626, 41628, 41629, 41630, 41632, 41641, 41646, 41648, 41665, 41669, 41672, 41722, 41757, 41761, 41767, 41768, 41770, 41780, 41785, 41803, 41813, 41814, 41816, 41827, 41837, 41851, 41854, 41855, 41862, 41871, 41872, 41874, 41882, 41883, 41884, 41885, 41887, 41888, 41889, 41890, 41893, 41895, 41899, 41905, 41906, 41930, 41937, 41954, 41960, 41965, 41969, 41976, 41985, 42000, 42018, 42054, 42055, 42056, 42058, 42059, 42066, 42072, 42140, 42155, 42156, 42177, 42179, 42206, 42221, 42247, 42271, 42284, 42314, 42316, 42320, 42321, 42322, 42326, 42329, 42332, 42341, 42357, 42360, 42366, 42370, 42371, 42374, 42375, 42377, 42380, 42382, 42391, 42403

ENGINE OPERATING CYCLES
41194, 41214, 41217, 41218, 41227, 41228, 41229, 41230, 41237, 41250, 41257, 41264, 41266, 41269, 41283, 41322, 41355, 41356, 41405, 41440, 41463, 41465, 41466, 41474, 41504, 41555, 41560, 41573, 41590, 41608, 41641, 41722, 41827, 42316

ENGINE OPERATION MODIFICATION
41214, 41218, 41229, 41236, 41237, 41238, 41248, 41262, 41268, 41274, 41323, 41355, 41356, 41414, 41430, 41440, 41442, 41448, 41449, 41451, 41462, 41465, 41466, 41468, 41487, 41492, 41494, 41507, 41511, 41525, 41542, 41569, 41573, 41593, 41612, 41614, 41616, 41628, 41641, 41780, 42320

ENGINEERS
42340

ENGINES
41194, 41202, 41203, 41217, 41218, 41219, 41226, 41227, 41228, 41230, 41236, 41237, 41241, 41245, 41248, 41250, 41257, 41261, 41262, 41264, 41268, 41274, 41276, 41283, 41290, 41301, 41313, 41322, 41347, 41361, 41368, 41369, 41400, 41405, 41421, 41422, 41430, 41441, 41442, 41448, 41451, 41463, 41473, 41474, 41478, 41486, 41487, 41494, 41507, 41512, 41535, 41536, 41550, 41555, 41560, 41573, 41580, 41582, 41590, 41601, 41608, 41610, 41616, 41628, 41629, 41632, 41641, 41643, 41669, 41672, 41761, 41780, 41803, 41813, 41814, 42018, 42036, 42316, 42326, 42357

ENZYMES
41210, 42107, 42120, 42126, 42131, 42136, 42159, 42161, 42187

EPIDEMIOLOGY
41645, 41736, 42092, 42093, 42095, 42098, 42101, 42104, 42106, 42108, 42114, 42115, 42121, 42133, 42138, 42150, 42154, 42158, 42162, 42172, 42180, 42189, 42193, 42201, 42395, 42403, 42405

EPITHELIUM
42094, 42125, 42140

EQUIPMENT STANDARDS
41774, 41801

ERYTHEMA
42118

ESTERS
41925

ETHERS
41758, 42123

ETHYL ALCOHOL
41514

ETHYLENE
41372, 41746, 41882, 42054, 42073, 42198, 42268, 42273, 42402

EUROPE
41194, 41195, 41198, 41200, 41201, 41206, 41207, 41209, 41212, 41215, 41217, 41219, 41221, 41222, 41223, 41224, 41231, 41239, 41240, 41249, 41253, 41258, 41260, 41265, 41270, 41271, 41274, 41275, 41276, 41277, 41279, 41280, 41281, 41282, 41283, 41284, 41285, 41286, 41290, 41292, 41295, 41298, 41300, 41302, 41308, 41309, 41310, 41312, 41313, 41315, 41319, 41320, 41324, 41325, 41326, 41327, 41328, 41329, 41334, 41335, 41336, 41340, 41342, 41343, 41345, 41346, 41348, 41351, 41359, 41361, 41362, 41366, 41367, 41369, 41373, 41387, 41390, 41393, 41394, 41399, 41401, 41402, 41403, 41411, 41412, 41415, 41416, 41418, 41420, 41421, 41422, 41426, 41428, 41429, 41430, 41431, 41436, 41438, 41439, 41440, 41446, 41452, 41453, 41454, 41457, 41461, 41462, 41468, 41470, 41476, 41478, 41479, 41480, 41481, 41483, 41486, 41488, 41489, 41491, 41493, 41494, 41498, 41500, 41501, 41503, 41506, 41510, 41511, 41513, 41514, 41515, 41517, 41521, 41522, 41523, 41524, 41526, 41531, 41538, 41539, 41546, 41547, 41554, 41566, 41569, 41570, 41571, 41572, 41575, 41581, 41585, 41587, 41588, 41590, 41600, 41602, 41606, 41607, 41608, 41611, 41613, 41616, 41619, 41620, 41621, 41632, 41638, 41639, 41644, 41645, 41646, 41647, 41648, 41649, 41655, 41656, 41657, 41659, 41662, 41663, 41664, 41665, 41666, 41669, 41677, 41678, 41679, 41681, 41682, 41683, 41684, 41686, 41687, 41689, 41691, 41696, 41697, 41698, 41699, 41700, 41701, 41708, 41710, 41712, 41713, 41714, 41715, 41718, 41720, 41728, 41730, 41731, 41732, 41737, 41744, 41758, 41759, 41760, 41761, 41771, 41773, 41775, 41786, 41787, 41789, 41790, 41792, 41796, 41798, 41805, 41806, 41809, 41817, 41819, 41820, 41823, 41824, 41825, 41826, 41827, 41828, 41829, 41831, 41832, 41833, 41837, 41838, 41839, 41840, 41841, 41842, 41843, 41845, 41846, 41847, 41851, 41852, 41853, 41859, 41863, 41866, 41883, 41895, 41896, 41900, 41901, 41902, 41903, 41905, 41906, 41907, 41908, 41909, 41910, 41911, 41912, 41914, 41915, 41916, 41917, 41919, 41923, 41929, 41931, 41938, 41939, 41943, 41951, 41952, 41957, 41958, 41960, 41966, 41974, 41992, 41993, 41994, 41995, 41996, 41997, 42000, 42001, 42002, 42003, 42004, 42005, 42006, 42007, 42009, 42010, 42011, 42012, 42013, 42014, 42017, 42024, 42032, 42044, 42045, 42049, 42052, 42053, 42059, 42060, 42077, 42078, 42080, 42081, 42082, 42083, 42085, 42086, 42087, 42088, 42089, 42090, 42093, 42096, 42098, 42099, 42106, 42109, 42118, 42119, 42123, 42126, 42127, 42128, 42136, 42137, 42141, 42146, 42147, 42150, 42152, 42163, 42165, 42166, 42167, 42168, 42172, 42173, 42174, 42175, 42176, 42177, 42179, 42180, 42185, 42187, 42188, 42190, 42191, 42192, 42194, 42198, 42199, 42200, 42202, 42203, 42208, 42209, 42215, 42216, 42221, 42223, 42238, 42243, 42246, 42248, 42256, 42261, 42263, 42269, 42274, 42277, 42278, 42279, 42280, 42282, 42283, 42285, 42287, 42288, 42291, 42298, 42303, 42309, 42311, 42312, 42333, 42363, 42372, 42374, 42377, 42393, 42396, 42398, 42399, 42401, 42403

EVAPORATORS
41357

EXCESS AIR
41217, 41226, 41286, 41371, 41385, 41486, 41494, 41497, 41581, 41742, 42045, 42403

EXCRETIONS
42099, 42118, 42120, 42126, 42129, 42151, 42165, 42168, 42173, 42177, 42185, 42187, 42191, 42192, 42194, 42198, 42208

EXHAUST SYSTEMS
41279, 41311, 41315, 41326, 41330, 41404, 41428, 41470, 41506, 41568, 41599, 41623, 42135

EXPERIMENTAL EQUIPMENT
41460, 41622, 41793, 41802, 42070, 42166, 42232

EXPERIMENTAL METHODS
41203, 41214, 41241, 41448, 41460, 41688, 41694, 41747, 41802, 41823, 41827, 42091, 42097, 42232

EXPLOSIONS
41321, 41509, 41596, 41717, 41870, 41979, 41981, 42045, 42158

EXPOSURE CHAMBERS
42070, 42227, 42228, 42230, 42237, 42261, 42287, 42288

EXPOSURE METHODS
41607, 42100, 42109, 42129, 42147, 42161, 42164, 42267, 42268, 42277

EXTERNAL COMBUSTION ENGINES
41400, 41473, 41601, 41610

EYE IRRITATION
42064, 42101, 42206

EYES
42142

F

FABRIC FILTERS
41247, 41351, 41412, 41470, 41477, 41545, 41635

FALLOUT
41897, 42256

FANS (BLOWERS)
41330, 41404

FARMS
41246, 41252, 41849, 42210, 42404

FEASIBILITY STUDIES
41598, 41642

FERROALLOYS
42281, 42284

FIELD TESTS
41346, 41711, 41719, 41779, 41865

FILTER FABRICS
41231, 41325, 41426, 41429, 41439, 41454, 41458, 41459, 41470, 41538, 41547, 41584, 41597, 41613, 41649, 41657, 41681, 41682, 41685, 41686, 41688, 41744, 41753, 41838, 41865, 42077

FILTERS
41209, 41231, 41247, 41294, 41315, 41325, 41329, 41330, 41333, 41335, 41343, 41351, 41358, 41363, 41375, 41381, 41411, 41412, 41426, 41429, 41439, 41446, 41454, 41458, 41459, 41464, 41470, 41477, 41499, 41500, 41512, 41514, 41538, 41539, 41545, 41547, 41552, 41555, 41584, 41597, 41613, 41625, 41635, 41636, 41645, 41649, 41655, 41657, 41679, 41681, 41682, 41685, 41686, 41688, 41713, 41714, 41735, 41744, 41753, 41754, 41765, 41784, 41815, 41818, 41838, 41839, 41865, 42077, 42221, 42311

FINLAND
41656, 42106

FIRING METHODS
41204, 41206, 41208, 41217, 41226, 41236, 41240, 41247, 41274, 41286, 41289, 41361, 41369, 41371, 41385, 41448, 41449, 41452, 41466, 41472, 41478, 41486, 41494, 41497, 41509, 41511, 41551, 41560, 41581, 41604, 41627, 41742, 42045, 42403

FLAME AFTERBURNERS
41300, 41313, 41336, 41466, 41492, 41612, 41667, 41674

FLAME IONIZATION DETECTOR (CO)
41278, 41704, 41712, 41722, 41725, 41740, 41743, 41760, 41767, 41770, 41800, 41813, 41814, 41885

FLARES
41617

FLORIDA
42318

FLOWERS
42228, 42236, 42241, 42249, 42259

FLOWMETERS
41754, 41840

FLUID FLOW
41242, 41458, 41544, 41548, 41577, 41587, 41647, 41663, 41676, 41685, 41704, 41721, 41793, 41810, 41921, 41922, 41935, 41964, 41982, 42022, 42024, 42029, 42071, 42077, 42081, 42083, 42086, 42284, 42286

FLUORESCENCE
41273, 41703, 41745, 41746, 41750, 41776, 41855

FLUORIDES
41231, 41351, 41513, 41545, 41680, 41710, 41781, 41817, 41865, 41913, 41958, 42092, 42215, 42255, 42273, 42277, 42393, 42402

FLUORINATED HYDROCARBONS
41692, 41820

FLUORINE
41547

FLUORINE COMPOUNDS
41231, 41351, 41488, 41513, 41545, 41547, 41671, 41680, 41710, 41781, 41817, 41865, 41913, 41958, 42092, 42215, 42255, 42261, 42273, 42277, 42283, 42393, 42402

FLUOROSIS
42215

FLY ASH
41196, 41239, 41247, 41253, 41272, 41273, 41295, 41296, 41303, 41306, 41307, 41316, 41331, 41332, 41339, 41367, 41374, 41377, 41388, 41389, 41391, 41392, 41403, 41408, 41409, 41410, 41417, 41433, 41435, 41436, 41455, 41456, 41467, 41480, 41587, 41659, 41719, 41756, 41819, 42047, 42224, 42294

FOG
41221, 41570, 41790, 41845, 41876, 41909, 41939, 41966, 41974, 41985, 41992, 42013, 42167

FOOD AND KINDRED PRODUCTS INDUSTRY
41246, 41252, 41291, 41300, 41311, 41406, 41467, 41579, 41849, 42312

FORESTS
41791, 41942, 41982, 41994, 41999, 42272

FORMALDEHYDES
41230, 41753, 41757, 41785, 41821, 41826, 41844, 41862, 42054, 42058, 42064

FRACTIONATION
42143

FRANCE
41280, 41286, 41319, 41320, 41387, 41416, 41418, 41428, 41461, 41462, 41494, 41503, 41514, 41547, 41585, 41646, 41669, 41679, 41684, 41697, 41701, 41712, 41761, 41839, 41852, 41900, 41901, 41902, 41903, 41906, 41907, 41908, 41909, 41910, 41952, 42080, 42087, 42096, 42152, 42167, 42187, 42285, 42372

FREE RADICALS
42027, 42028

FREEZING
41198, 41404, 41705, 42085

FUEL ADDITIVES
41217, 41250, 41323, 41449, 41532, 41556, 41627, 41672, 41874, 42174, 42177, 42221, 42326, 42405

FUEL CELLS
41386, 41462, 41669, 42293

FUEL CHARACTERISTICS
41223, 41265, 41591, 42047, 42163, 42171, 42309

FUEL CHARGING
41247, 41274, 41369, 41448, 41466, 41551, 41560

FUEL CRITERIA
41554

FUEL EVAPORATION
41338, 41379, 41530, 41557, 41580, 41609, 41614, 42360

FUEL GASES
41215, 41222, 41235, 41238, 41240, 41258, 41312, 41327, 41338, 41340, 41366, 41397, 41420, 41421, 41422, 41472, 41479, 41489, 41494, 41529, 41576, 41578, 41588, 41602, 41640, 41648, 41678, 41853, 41885, 41990, 42293, 42306, 42313, 42376, 42399

FUEL OIL PREPARATION
41332, 41423, 41434, 41462, 41493, 41496, 41603, 41611, 41631, 41634

FUEL OILS
41202, 41205, 41215, 41217, 41222, 41238, 41258, 41272, 41273, 41285, 41289, 41308, 41323, 41401, 41418, 41423, 41462, 41493, 41532, 41578, 41627, 41631, 41648, 41664, 41721, 41756, 41990, 42076, 42295, 42306, 42313, 42376, 42377, 42379

FUEL RESOURCES
41631, 42171

FUEL STANDARDS
41598, 42334, 42377

FUEL TANK EVAPORATION
41379, 41557, 41580, 41609

FUEL TREATMENT
41196, 41204, 41265, 41297, 41302, 41304, 41309, 41332, 41340, 41360, 41367, 41393, 41394, 41396, 41415, 41423, 41427, 41434, 41438, 41462, 41493, 41496, 41506, 41537, 41576, 41583, 41591, 41602, 41603, 41604, 41611, 41631, 41634, 41678, 42293, 42377, 42405

FUMES
41193, 41359, 41379, 41450, 41625, 41636, 41680, 41766, 42017, 42392

FUNGI
41989, 41992, 42249

FURNACES
41193, 41206, 41208, 41238, 41253, 41270, 41272, 41279, 41289, 41297, 41332, 41341, 41360, 41382, 41385, 41394, 41444, 41445, 41470, 41472, 41486, 41503, 41506, 41509, 41532, 41571, 41581, 41604, 41622, 41623, 41635, 41664, 41720, 41743, 41877, 41898, 42057, 42313, 42379

G

GAS CHROMATOGRAPHY
41202, 41219, 41278, 41397, 41699, 41704, 41712, 41722, 41723, 41725, 41729, 41740, 41743, 41760, 41767, 41768, 41769, 41770, 41800, 41802, 41811, 41813, 41814, 41820, 41830, 41885, 41927, 42018

GAS SAMPLING
41582, 41612, 41696, 41699, 41701, 41710, 41711, 41719, 41743, 41755, 41758, 41766, 41767, 41781, 41783, 41784, 41793, 41809, 41811, 41815, 41830, 41839, 41865

GAS TURBINE ENGINES
41194, 41218, 41236, 41241, 41245, 41276, 41322, 41361, 41369, 41400, 41442, 41535, 41560, 41601, 41610, 41669, 41780, 41813, 41814, 42036, 42316

GASIFICATION
41196, 41297, 41304, 41332, 41340, 41367, 41393, 41415, 41423, 41438, 41462, 41506, 41537, 41576, 41591, 41604, 42293, 42405

GASOLINES
41219, 41230, 41237, 41250, 41323, 41379, 41462, 41465, 41492, 41494, 41530, 41533, 41556, 41580, 41617, 41756, 41874, 41885, 42059, 42320, 42326, 42360

GENETICS
42157, 42223

GERMANY, FEDERAL REPUBLIC
41194, 41198, 41200, 41201, 41207, 41209, 41212, 41217, 41219, 41222, 41249, 41253, 41265, 41274, 41279, 41290, 41298, 41300, 41308, 41309, 41312, 41325, 41326, 41327, 41328, 41335, 41336, 41340, 41342, 41343, 41348, 41351, 41361, 41362, 41367, 41402, 41412, 41415, 41420, 41421, 41422, 41426, 41429, 41430, 41431, 41438, 41446, 41452, 41453, 41454, 41468, 41470, 41476, 41478, 41479, 41483, 41488, 41489, 41491, 41501, 41510, 41513, 41517, 41524, 41531, 41538, 41539, 41569, 41570, 41571, 41575, 41602, 41608, 41616, 41619, 41620, 41621, 41644, 41677, 41678, 41699, 41700, 41710, 41713, 41714, 41718, 41720, 41731, 41732, 41771, 41806, 41809, 41817, 41828, 41831, 41833, 41837, 41846, 41853, 41859, 41900, 41914, 41915, 41923, 41929, 41943, 41957, 41966, 41993, 41997, 42000, 42009, 42010, 42024, 42032, 42044, 42053, 42060, 42089, 42099, 42118, 42136, 42146, 42165, 42168, 42173, 42174, 42199, 42202, 42203, 42208, 42209, 42215, 42216, 42221, 42238, 42261, 42269, 42277, 42282, 42283, 42298, 42312, 42333, 42363, 42393, 42396

GLANDS
42165, 42175

GLASS
41450, 41454, 41513, 41707

GLASS FABRICS
41426, 41744, 41753

GRAIN PROCESSING
41579

GRANTS
42336, 42366

GRAPHITE
41328, 41735, 42020

GRASSES
42228, 42263, 42264

GRAVITY COLLECTORS
41425, 41586

GRAVITY SETTLING (CONTROL)
41375, 41390, 41544, 41685, 41724, 41897

GREAT BRITAIN
41195, 41215, 41239, 41240, 41258, 41276, 41281, 41283, 41284, 41295, 41315, 41324, 41345, 41346, 41394, 41401, 41436, 41439, 41440, 41481, 41486, 41493, 41500, 41506, 41521, 41522, 41523, 41546, 41554, 41572, 41590, 41606, 41611, 41632, 41691, 41696, 41708, 41761, 41775, 41789, 41798, 41819, 41842, 41883, 41900, 41919, 41939, 41958, 41960, 42014, 42017, 42081, 42150, 42163, 42172, 42177, 42179, 42188, 42243, 42248, 42263, 42279, 42280, 42287, 42288, 42303, 42374, 42399, 42401

GREENHOUSES
42210, 42219, 42224, 42240, 42244

GROUND LEVEL
41838, 41891, 41917, 41918, 41921, 41922, 41924, 41932, 41936, 41937, 41940, 41952, 41958, 41963, 41975, 41999, 42007, 42305, 42362, 42364, 42393

GUINEA PIGS
41319, 42119, 42136

H

HALOGEN GASES
41547, 41571, 41595, 41666, 41855, 41862, 42175, 42262

HALOGENATED HYDROCARBONS
41195, 41282, 41692, 41820, 41822, 41927, 41938, 41996, 42109, 42123, 42170, 42178

HAMSTERS
42070

HARBORS
41948, 41950

HAWAII
42158

HAZE
41249, 41876, 41882

HEADACHE
42101

HEALTH IMPAIRMENT
41707, 41804, 41862, 41989, 42096, 42105, 42113, 42115, 42116, 42131, 42133, 42138, 42145, 42147, 42150, 42161, 42163, 42190, 42195, 42197, 42207, 42327, 42374, 42392, 42395

HEALTH STATISTICS
42092, 42115, 42149, 42158, 42180

HEART
42159, 42164

HEAT TRANSFER
41198, 41221, 41311, 41362, 41394, 41404, 41486, 41562, 41570, 41667, 41689, 41705, 41915, 41970, 42085

HEAVY-DUTY VEHICLES
41227, 41228, 41237, 41262, 41264, 41269, 41281, 41338, 41366, 41420, 42391, 42398

HEIGHT FINDING
41963, 42364, 42393

HEMATOLOGY
41607, 42102, 42104, 42105, 42113, 42116, 42117, 42120, 42126, 42129, 42130, 42132, 42146, 42150, 42151, 42153, 42155, 42156, 42164, 42173, 42174, 42177, 42181, 42185, 42187, 42188, 42191, 42194, 42203, 42208, 42278

HEMOGLOBIN
42120, 42126, 42146, 42151, 42173, 42194, 42208

HEPTANES
41230

HERBICIDES
41925, 42245

HERBS
41958

HEXANES
41758, 41869

HI-VOL SAMPLERS
41706, 41716, 41744, 41892

HIGHWAYS
41202, 41283, 41855, 41872, 41874, 41895, 41900, 41937, 41954, 41969, 42155, 42271, 42341

HOGS
42238

HUMIDITY
41404, 41413, 41560, 41739, 41860, 41871, 41915, 41919, 41920, 41950, 41964, 41974, 42000, 42013, 42042, 42044, 42056, 42167, 42254, 42282, 42286, 42289, 42290, 42291, 42364

HYDRAZINES
41386

HYDROCHLORIC ACID
41255, 41571, 41584, 41596, 41700, 41710, 41742, 41743, 41859, 41865, 41901, 41996, 42127, 42281, 42285, 42402

HYDROCYANIC ACID
41277, 41489, 41712

HYDRODESULFURIZATION
41434, 41462, 41493, 41603, 41631, 41634

HYDROFLUORIC ACID
41231, 41584, 41700, 41817, 41865, 42261, 42277, 42281

HYDROGEN
41231, 41236, 41304, 41317, 41324, 41365, 41462, 41471, 41550, 41576, 41603, 41763, 42039, 42045, 42050, 42076, 42293, 42402

HYDROGEN SULFIDE
41280, 41291, 41299, 41312, 41314, 41336, 41357, 41360, 41471, 41479, 41485, 41489, 41493, 41529, 41531, 41534, 41545, 41546, 41553, 41588, 41600, 41611, 41678, 41698, 41700, 41712, 41759, 41760, 41763, 41779, 41794, 41798, 41849, 41926, 41929, 41960, 42039, 42041, 42282, 42291

HYDROGENATION
41299, 41393, 41415, 41423, 41427, 41462, 41485

HYDROLYSIS
41210, 41299, 41485, 42072

HYDROSPHERE
41782, 41934

HYDROXIDES
41254, 41308, 41407, 41539, 41596, 41670, 41828, 41863, 41943, 42038

HYGROSCOPICITY
42002, 42044

HYPERSENSITIVITY
42106, 42142, 42184

HYPOXIA
41607

I

ICE
41414, 41967, 41968, 41971, 41986, 42015

ILLINOIS
41897, 42315, 42382

IMMUNOLOGY
42106, 42111, 42112, 42113, 42147, 42184

IMPINGEMENT
41693, 41834

INCINERATORS (REFUSE)
41198, 41213, 41253, 41256, 41263, 41271, 41287, 41312, 41341, 41383, 41415, 41416, 41426, 41452, 41497, 41499, 41509, 41516, 41518, 41534, 41563, 41571, 41594, 41598, 41617, 41667, 41742, 41743, 41815, 41855, 41933, 42281, 42325, 42379

INCINERATORS (WASTE GASES)
41198, 41234, 41262, 41274, 41300, 41305, 41309, 41313, 41323, 41336, 41340, 41372, 41376, 41402, 41441, 41449, 41461, 41462, 41466, 41478, 41483, 41492, 41493, 41494, 41507, 41511, 41518, 41533, 41556, 41565, 41566, 41568, 41597, 41599, 41612, 41628, 41641, 41644, 41646, 41653, 41654, 41667, 41668, 41674, 42067, 42320, 42326, 42403

INDIANA
41897, 41991, 42315

INDOOR
41231, 41290, 41378, 41877, 41893

INDUSTRIAL AREAS
41202, 41224, 41243, 41278, 41280, 41285, 41736, 41773, 41826, 41845, 41848, 41865, 41894, 41900, 41901, 41902, 41912, 41913, 41914, 41957, 41958, 41964, 41995, 42092, 42104, 42163, 42223, 42258, 42260, 42261, 42262, 42264, 42373

INERTIAL SEPARATION
41458, 41499, 41897

INFECTIOUS DISEASES
42119, 42138, 42147, 42196, 42204

INFRARED RADIATION
41704, 41985, 42073

INFRARED SPECTROMETRY
41690, 41692, 41704, 41708, 41710, 41712, 41722, 41725, 41738, 41742, 41746, 41764, 41769, 41796, 41814, 41831, 42054, 42063

INGESTION
42114, 42146, 42161, 42203, 42215, 42278

INHALATION THERAPY
42089, 42202, 42203

INHIBITION
42045, 42139, 42159, 42275

INORGANIC ACIDS
41195, 41231, 41234, 41255, 41292, 41312, 41328, 41342, 41352, 41365, 41389, 41392, 41434, 41471, 41495, 41501, 41502, 41505, 41508, 41513, 41516, 41521, 41522, 41546, 41563, 41571, 41584, 41596, 41613, 41627, 41677, 41700, 41701, 41710, 41742, 41743, 41762, 41781, 41817, 41856, 41859, 41865, 41901, 41919, 41996, 42095, 42127, 42243, 42261, 42277, 42281, 42282, 42285, 42291, 42303, 42313, 42402

INSPECTION
41474, 41827, 42326, 42329, 42382, 42405

INSTRUMENTATION
41440, 41702, 41715, 41718, 41719, 41734, 41738, 41740, 41747, 41748, 41752, 41774, 41779, 41782, 41788, 41789, 41792, 41793, 41799, 41800, 41805, 41807, 41808, 41812, 41813, 41815, 41816, 41817, 41821, 41839, 41840, 41842, 42287, 42385, 42405

INTERNAL COMBUSTION ENGINES
41202, 41203, 41217, 41219, 41226, 41227, 41228, 41230, 41237, 41248, 41250, 41257, 41261, 41262, 41264, 41268, 41274, 41283, 41290, 41301, 41313, 41347, 41368, 41400, 41405, 41421, 41422, 41430, 41441, 41448, 41451, 41463, 41474, 41478, 41486, 41487, 41494, 41507, 41512, 41536, 41550, 41555, 41573, 41580, 41582, 41590, 41601, 41608, 41610, 41616, 41628, 41629, 41632, 41641, 41643, 41672, 41761, 41803, 42018, 42326, 42357

INVERSION
41564, 41727, 41881, 41924, 41930, 41936, 41946, 41950, 41952, 41970, 42001, 42009, 42167

IODIMETRIC METHODS
41725, 41741, 41743, 41771, 41805, 41857, 41889, 41905

IODINE
42175

IONIZATION
41928, 42014, 42041, 42105

IONS
41495, 41773, 41806, 41856, 41879, 41883,
41912, 41928, 41929, 42005, 42213, 42217,
42276

IOWA
42358, 42359

IRON
41193, 41207, 41275, 41288, 41310, 41405,
41445, 41447, 41488, 41619, 41630, 41632,
41664, 41878, 41913, 41995, 42039, 42050,
42092, 42280, 42282, 42283

IRON COMPOUNDS
41528, 41585, 41670, 41716, 41761, 41855,
41891, 41904, 41995, 42004, 42146

IRON OXIDES
41403, 41546, 41585, 41595, 41798, 41997

IRRADIATION CHAMBERS
41854, 42054, 42058, 42061

ISOTOPES
41212, 41781

ITALY
41313, 41334, 41588, 41648, 41758, 41851,
41900, 41916, 42109

J

JAPAN
41203, 41204, 41211, 41213, 41218, 41225,
41227, 41228, 41229, 41230, 41242, 41268,
41278, 41289, 41291, 41293, 41308, 41322,
41330, 41341, 41349, 41350, 41352, 41353,
41354, 41355, 41356, 41357, 41358, 41363,
41364, 41365, 41370, 41371, 41373, 41378,
41379, 41380, 41381, 41382, 41383, 41395,
41396, 41397, 41404, 41406, 41423, 41425,
41443, 41444, 41445, 41448, 41449, 41460,
41469, 41471, 41472, 41482, 41519, 41527,
41528, 41541, 41542, 41543, 41548, 41550,
41552, 41567, 41578, 41580, 41582, 41599,
41622, 41623, 41624, 41630, 41633, 41635,
41661, 41670, 41690, 41716, 41722, 41723,
41724, 41725, 41727, 41729, 41733, 41734,
41736, 41738, 41739, 41740, 41741, 41742,
41743, 41749, 41752, 41753, 41754, 41755,
41757, 41761, 41765, 41766, 41768, 41784,
41785, 41793, 41802, 41810, 41811, 41827,
41848, 41849, 41850, 41854, 41856, 41857,
41858, 41861, 41862, 41864, 41865, 41869,
41872, 41873, 41876, 41877, 41878, 41879,
41881, 41886, 41887, 41888, 41889, 41890,
41891, 41898, 41899, 41904, 41921, 41922,
41928, 41930, 41935, 41936, 41937, 41945,
41948, 41950, 41956, 41962, 41965, 41978,
42025, 42026, 42027, 42028, 42036, 42038,
42041, 42043, 42046, 42051, 42054, 42055,
42056, 42058, 42068, 42069, 42101, 42111,
42112, 42113, 42115, 42116, 42120, 42121,
42129, 42132, 42133, 42134, 42140, 42142,
42145, 42154, 42164, 42182, 42212, 42214,
42218, 42219, 42220, 42222, 42225, 42226,
42228, 42229, 42230, 42231, 42233, 42234,
42235, 42237, 42239, 42240, 42241, 42247,
42251, 42253, 42257, 42258, 42265, 42266,
42267, 42268, 42276, 42295, 42299, 42302,
42313, 42320, 42321, 42322, 42323, 42328,
42332, 42337, 42352, 42362, 42364, 42379,
42395, 42400, 42404

JET AIRCRAFT
41197, 41236, 41267, 41276, 41486, 41499,
41551, 41560, 41747, 41813, 41814, 41979,
41985, 42316

K

KANAGAWA PREFECTURE
41888, 41891, 42258, 42379

KANSAS
42348

KENTUCKY
42371

KEROSENE
41218, 41322, 41379, 42181

KETONES
41546, 41758, 41820, 41863, 42123, 42127

KIDNEYS
42114, 42118, 42188, 42208, 42392

KILNS
41198, 41253, 41254, 41296, 41307, 41332,
41351, 41391, 41407, 41433, 41506, 41517,
41561, 41567, 41595, 41635, 41665

KRAFT (SULFATE) PULPING
41208, 41357, 41431, 41434, 41455, 41674,
41689

L

LABORATORY ANIMALS
41256, 42113, 42147, 42150

LABORATORY FACILITIES
41376, 41405

LACQUERS
41426

LAKES
41996, 42256

LAND USE PLANNING
41239, 41259, 41283, 41285, 41295, 41316,
41469, 42247, 42307, 42308, 42331, 42365,
42397

LANDFILLS
41295, 41316, 41410

LARYNX
42204

LASERS
41727, 41733, 41746, 41796, 42031, 42044,
42048

LATIN AMERICA
41318, 41860

LAUNDERING (COAL)
41332, 41604

LEAD
41243, 41434, 41439, 42192, 42260, 42285

LEAD COMPOUNDS
41243, 41250, 41273, 41315, 41323, 41492,
41525, 41533, 41716, 41726, 41735, 41851,
41855, 41859, 41870, 41874, 41883, 41884,
41887, 41891, 41892, 41895, 41898, 41900,
41904, 41942, 41954, 41960, 41964, 42004,
42059, 42092, 42096, 42097, 42099, 42104,
42105, 42120, 42126, 42129, 42151, 42162,
42163, 42165, 42168, 42171, 42173, 42177,
42185, 42187, 42188, 42189, 42191, 42192,
42194, 42198, 42216, 42221, 42223, 42247,
42260, 42264, 42269, 42271, 42323

LEAVES
41878, 42211, 42213, 42214, 42216, 42217,
42218, 42219, 42222, 42227, 42230, 42231,
42233, 42237, 42240, 42244, 42252, 42257,
42258, 42261, 42265, 42266, 42267, 42268,
42270, 42275, 42277, 42403

LEGISLATION
41235, 41284, 41468, 41492, 41554, 42300,
42310, 42316, 42326, 42327, 42329, 42331,
42363, 42367, 42368, 42370, 42371, 42374,
42376, 42377, 42378, 42387, 42390, 42394,
42401

LEUKOCYTES
42103, 42223

LIDAR
41727, 41836

LIGHT SCATTERING
41727, 41733, 41775, 41792, 41836, 41842,
41882, 41931, 41985, 41986, 42010, 42044,
42084

LIGHT-DUTY VEHICLES
41194, 41211, 41214, 41225, 41229, 41230,
41243, 41248, 41259, 41281, 41283, 41323,
41353, 41355, 41356, 41366, 41405, 41430,
41449, 41461, 41462, 41463, 41464, 41465,
41466, 41468, 41474, 41492, 41504, 41511,
41512, 41525, 41535, 41542, 41565, 41582,
41593, 41599, 41601, 41630, 41648, 41669,
41722, 41770, 41854, 41862, 41871, 41883,
41887, 42000, 42058, 42320, 42321, 42322,
42326, 42332, 42370, 42382, 42386, 42391,
42403

LIME KILNS
41254, 41296, 41307, 41332, 41351, 41391,
41433, 41517, 41561, 41595, 41635, 41665

LIMESTONE
41254, 41279, 41308, 41332, 41360, 41391,
41433, 41503, 41561, 41587, 42305

LINE SOURCES
41972, 41991, 41999

LIPIDS
41607, 42160, 42161, 42174, 42217, 42252

LITHIUM COMPOUNDS
41596, 42022

LITIGATION
42389

LIVER
42118, 42146, 42187, 42188, 42208

LOCAL GOVERNMENTS
42376

LOS ANGELES
41864, 41930, 42143, 42402

LOWER ATMOSPHERE
41197, 41255, 41782, 41794, 41807, 41922,
41923, 41924, 41929, 41937, 41940, 41943,
41945, 41947, 41966, 41978, 41979, 42003,
42005, 42066, 42364

LUBRICANTS
41305, 41323

LUNG CANCER
42112, 42140, 42154, 42179, 42182, 42183,
42186, 42201

LUNG CLEARANCE
42103, 42112, 42160, 42171, 42204

LUNGS
41255, 42070, 42094, 42103, 42112, 42118,
42119, 42122, 42124, 42125, 42131, 42136,
42137, 42140, 42141, 42145, 42148, 42152,
42160, 42161, 42172, 42199, 42253

LYMPHOCYTES
42100

M

MAGNESIUM
41666

MAGNESIUM COMPOUNDS
41320, 41360, 41407, 41418, 41522, 41532, 41548, 41627, 41651, 41748, 41883, 42004, 42285, 42305

MAGNETIC PROPERTIES
41621

MAINTENANCE
41214, 41286, 41300, 41378, 41407, 41460, 41552, 41567, 41606, 41625, 41681, 41684, 41690, 41754, 41755, 42300, 42329, 42382

MANAGEMENT PERSONNEL
42383

MANGANESE
41566, 41878, 42037, 42060

MANGANESE COMPOUNDS
41350, 41532, 41605, 41716, 41748, 41855, 41891, 41904, 42004, 42038, 42057, 42119, 42260, 42264

MANGANESE DIOXIDE PROCESS
41350, 41578

MANUFACTURING INDUSTRIES
41193, 41207, 41208, 41209, 41216, 41231, 41235, 41246, 41252, 41270, 41277, 41285, 41291, 41300, 41310, 41311, 41335, 41357, 41406, 41416, 41428, 41431, 41434, 41439, 41455, 41462, 41467, 41470, 41493, 41524, 41545, 41579, 41597, 41611, 41620, 41634, 41651, 41668, 41671, 41674, 41680, 41689, 41769, 41849, 41859, 41865, 41877, 41898, 41901, 41902, 41904, 41950, 41957, 42046, 42059, 42168, 42173, 42189, 42190, 42223, 42238, 42312, 42333, 42388

MAPPING
41691, 41791, 41949, 41958, 42211, 42246, 42385

MARYLAND
41867

MASS SPECTROMETRY
41202, 41699, 41717, 41723, 42018

MASS TRANSPORTATION
41211, 41259, 41621, 41626, 41642

MASSACHUSETTS
42211

MATHEMATICAL ANALYSES
41208, 41220, 41236, 41242, 41244, 41245, 41251, 41266, 41346, 41390, 41440, 41448, 41458, 41459, 41487, 41523, 41536, 41544, 41562, 41564, 41577, 41587, 41591, 41633, 41639, 41647, 41650, 41655, 41657, 41663, 41673, 41721, 41724, 41730, 41770, 41807, 41866, 41872, 41933, 41934, 41955, 41961, 41967, 41968, 41970, 41975, 41977, 41982, 42005, 42007, 42011, 42015, 42019, 42029, 42036, 42040, 42045, 42049, 42061, 42066, 42075, 42077, 42078, 42081, 42083, 42084, 42086, 42087, 42114, 42148, 42204, 42290, 42298, 42301, 42302, 42304, 42305, 42307, 42324, 42339, 42362, 42382, 42402

MATHEMATICAL MODELING
41208, 41220, 41236, 41245, 41251, 41266, 41346, 41448, 41458, 41459, 41487, 41523, 41544, 41562, 41564, 41587, 41639, 41650, 41673, 41866, 41933, 41934, 41955, 41961, 41968, 41975, 41977, 42007, 42011, 42015, 42029, 42036, 42040, 42045, 42061, 42066, 42075, 42084, 42114, 42148, 42204, 42298, 42301, 42302, 42305, 42307, 42339, 42382, 42402

MAXIMUM ALLOWABLE CONCENTRATION
42291

MEETINGS
41601, 42322, 42340

MEMBRANE FILTRATION
41717, 41744, 41745, 41752, 41817, 41841, 41847, 41859, 41865

MEMBRANES
41717, 42142, 42205, 42217, 42225, 42252

MERCAPTANS
41291, 41357, 41493, 41759, 41849, 42046, 42291

MERCURY COMPOUNDS
41224, 41365, 41453, 41600, 41637, 41693, 41712, 41783, 41805, 41812, 41883, 41892, 41933, 41960, 42162, 42165, 42256, 42366

METABOLISM
41607, 42118, 42136, 42139, 42146, 42165, 42173, 42185, 42208, 42213

METAL COMPOUNDS
41224, 41243, 41244, 41250, 41254, 41255, 41272, 41273, 41282, 41307, 41308, 41315, 41320, 41323, 41333, 41342, 41349, 41350, 41360, 41365, 41394, 41407, 41413, 41418, 41450, 41453, 41488, 41492, 41496, 41518, 41522, 41525, 41528, 41532, 41533, 41539, 41540, 41546, 41548, 41556, 41574, 41585, 41587, 41595, 41596, 41600, 41605, 41622, 41627, 41631, 41637, 41651, 41666, 41670, 41693, 41694, 41697, 41712, 41716, 41726, 41735, 41745, 41748, 41752, 41756, 41761, 41783, 41805, 41812, 41819, 41820, 41841, 41851, 41855, 41859, 41870, 41874, 41882, 41883, 41884, 41887, 41891, 41892, 41895, 41898, 41900, 41904, 41929, 41933, 41942, 41954, 41960, 41964, 41995, 41997, 42004, 42022, 42038, 42057, 42059, 42069, 42091, 42092, 42096, 42097, 42099, 42104, 42105, 42114, 42118, 42119, 42120, 42126, 42129, 42144, 42146, 42151, 42162, 42163, 42165, 42168, 42171, 42173, 42175, 42177, 42185, 42187, 42188, 42189, 42191, 42192, 42194, 42198, 42213, 42216, 42217, 42221, 42223, 42224, 42238, 42243, 42247, 42256, 42257, 42258, 42260, 42264, 42269, 42271, 42277, 42285, 42286, 42290, 42305, 42306, 42323, 42366, 42392, 42402

METAL FABRICATION
41193, 41207, 41310, 41428, 41439, 41470, 41859, 41865, 41877, 41898, 41957, 42173, 42223, 42238

METAL INDUSTRIES
41270, 41277, 41335, 41434, 41524, 41620

METAL POISONING
42104, 42114, 42151, 42162, 42173, 42185, 42187, 42188, 42189, 42198, 42207, 42208

METALS
41193, 41207, 41243, 41275, 41288, 41310, 41345, 41353, 41372, 41405, 41406, 41434, 41439, 41441, 41445, 41447, 41481, 41483, 41488, 41490, 41531, 41533, 41565, 41566, 41603, 41611, 41619, 41630, 41632, 41638, 41654, 41664, 41666, 41693, 41820, 41865, 41878, 41894, 41913, 41958, 41995, 42020, 42034, 42037, 42039, 42050, 42051, 42053, 42060, 42067, 42092, 42192, 42260, 42280, 42281, 42282, 42283, 42284, 42285, 42289, 42291, 42292, 42317, 42403

METEOROLOGICAL INSTRUMENTS
41807, 41941, 42364

METEOROLOGY
41199, 41221, 41224, 41249, 41276, 41285, 41321, 41404, 41413, 41554, 41560, 41564, 41570, 41700, 41704, 41727, 41739, 41760, 41773, 41782, 41790, 41799, 41804, 41832, 41845, 41849, 41851, 41860, 41861, 41871, 41872, 41874, 41875, 41876, 41881, 41882, 41883, 41884, 41887, 41890, 41893, 41897, 41901, 41903, 41905, 41907, 41908, 41909, 41910, 41911, 41914, 41915, 41916, 41917, 41918, 41919, 41920, 41921, 41922, 41924, 41925, 41927, 41929, 41930, 41932, 41933, 41934, 41935, 41936, 41937, 41939, 41940, 41941, 41946, 41947, 41948, 41949, 41950, 41952, 41953, 41954, 41955, 41956, 41957, 41960, 41962, 41964, 41965, 41966, 41969, 41970, 41971, 41973, 41974, 41975, 41976, 41977, 41978, 41982, 41983, 41984, 41985, 41986, 41987, 41988, 41989, 41990, 41991, 41992, 41993, 41994, 41995, 41996, 41997, 41999, 42000, 42001, 42002, 42003, 42004, 42005, 42006, 42007, 42008, 42009, 42010, 42011, 42012, 42013, 42042, 42044, 42056, 42083, 42093, 42102, 42111, 42153, 42158, 42167, 42180, 42236, 42254, 42257, 42262, 42263, 42282, 42286, 42289, 42290, 42291, 42292, 42305, 42362, 42364, 42390, 42393, 42398, 42399, 42400, 42403, 42404, 42405

METHANES
41327, 41338, 41357, 41705, 41740, 41759, 41760, 41763, 41770, 41779, 41794, 41799, 41800, 41882, 41885, 41980, 42027, 42054, 42364

METROPOLITAN AREAS
41211, 41213, 41220, 41225, 41286, 41315, 41378, 41554, 41564, 41727, 41739, 41802, 41819, 41851, 41856, 41857, 41858, 41864, 41869, 41871, 41873, 41874, 41875, 41876, 41878, 41879, 41882, 41884, 41886, 41887, 41888, 41890, 41891, 41893, 41896, 41899, 41904, 41905, 41906, 41908, 41909, 41910, 41918, 41919, 41920, 41921, 41922, 41924, 41935, 41946, 41948, 41949, 41961, 41970, 41977, 41984, 41987, 41991, 42062, 42066, 42095, 42098, 42101, 42102, 42111, 42114, 42115, 42121, 42134, 42140, 42143, 42153, 42156, 42167, 42172, 42179, 42180, 42195, 42197, 42206, 42222, 42231, 42235, 42246, 42247, 42251, 42271, 42285, 42366, 42367, 42379, 42382, 42390, 42391, 42402, 42404

MICE
42070, 42100, 42109, 42123, 42131, 42136, 42139, 42143, 42145

MICHIGAN
42315

MICROMETEOROLOGY
41851, 41937, 41969, 41976, 41977

MICROORGANISMS
41683, 41825, 41943, 41980, 41989, 41992, 42009, 42021, 42078, 42107, 42119, 42143, 42204, 42249

MICROSCOPY
41769, 41843, 41845, 42152, 42218

MIDDLE ATMOSPHERE
41197, 41276, 41782, 41794, 41807, 41940, 41943, 41945, 41966, 41979, 41980, 41981

MINERAL PROCESSING
41247, 41345, 41351, 41454, 41513, 41863, 42135, 42151, 42207, 42393

MINING
41205, 41207, 41216, 41235, 41243, 41285, 41316, 41349, 41410, 41412, 41493, 41506, 41554, 41617, 41645, 41745, 42163, 42243, 42260, 42296, 42370, 42371

MINNESOTA
42315

MISSILE AND SPACECRAFT LAUNCH VEHICLES
41255, 41596, 41732, 41791, 41794, 41829

MISSOURI
41918, 41920, 41961, 42102, 42260

MISTS
41332, 41370, 41382, 41425, 41495, 41600, 41613, 41766, 41856

MOBILE EMISSION SOURCES
41194, 41197, 41201, 41211, 41214, 41220, 41225, 41227, 41228, 41229, 41230, 41234, 41236, 41237, 41242, 41243, 41248, 41252, 41255, 41257, 41259, 41261, 41262, 41264, 41266, 41267, 41269, 41274, 41276, 41281, 41283, 41284, 41309, 41315, 41323, 41324, 41338, 41340, 41353, 41355, 41356, 41358, 41366, 41372, 41396, 41400, 41405, 41414, 41420, 41421, 41425, 41430, 41449, 41461, 41462, 41463, 41464, 41465, 41466, 41468, 41474, 41483, 41486, 41492, 41493, 41499, 41504, 41511, 41512, 41525, 41535, 41541, 41542, 41551, 41560, 41565, 41566, 41573, 41580, 41582, 41593, 41596, 41599, 41601, 41608, 41616, 41621, 41626, 41630, 41642, 41645, 41646, 41648, 41669, 41722, 41732, 41747, 41757, 41767, 41768, 41770, 41782, 41785, 41791, 41794, 41813, 41814, 41829, 41837, 41851, 41854, 41855, 41862, 41871, 41872, 41874, 41882, 41883, 41884, 41885, 41887, 41888, 41889, 41890, 41893, 41895, 41899, 41905, 41906, 41924, 41930, 41937, 41954, 41957, 41960, 41965, 41969, 41976, 41979, 41985, 42000, 42054, 42055, 42056, 42058, 42059, 42072, 42179, 42211, 42221, 42247, 42260, 42271, 42314, 42316, 42319, 42320, 42321, 42322, 42326, 42329, 42332, 42341, 42357, 42363, 42364, 42365, 42366, 42367, 42370, 42371, 42374, 42375, 42377, 42380, 42382, 42386, 42391, 42398, 42403, 42405

MOLYBDENUM
41603, 41611

MOLYBDENUM COMPOUNDS
41244, 41272, 41273

MONITORING
41235, 41266, 41332, 41373, 41396, 41688, 41691, 41700, 41704, 41710, 41711, 41719, 41721, 41722, 41727, 41731, 41732, 41738, 41739, 41741, 41746, 41751, 41755, 41760, 41763, 41764, 41773, 41779, 41782, 41788, 41791, 41793, 41794, 41795, 41797, 41799, 41804, 41807, 41808, 41812, 41815, 41816, 41822, 41829, 41835, 41836, 41837, 41839, 41857, 41880, 41882, 41883, 41886, 41894, 41913, 41941, 41989, 41990, 42073, 42092, 42211, 42232, 42254, 42287, 42332, 42344, 42352, 42362, 42363, 42364, 42369, 42384, 42390, 42398, 42405

MONTHLY
41280, 41886, 41887, 41889, 41891, 41896, 41900, 41905, 41994

MORBIDITY
41736, 41791, 42093, 42095, 42096, 42098, 42115, 42121, 42133, 42140, 42154, 42167, 42179, 42182, 42189, 42403

MORTALITY
42092, 42098, 42149, 42179, 42189, 42201

MOTTLING
42226

MOUNTAINS
41861, 41865, 41950, 41992, 41993, 41997, 42004

N

NATIONAL AIR SAMPLING NETWORK (NASN)
41812

NATIONAL GOVERNMENTS
42325, 42336, 42366, 42367, 42376, 42378

NATURAL EMISSION SOURCES
41865, 41986, 42397

NATURAL GAS
41215, 41235, 41238, 41240, 41258, 41338, 41340, 41366, 41397, 41420, 41421, 41422, 41472, 41569, 41494, 41578, 41588, 41602, 41678, 41853, 41885, 41990, 42399

NEBRASKA
42357

NECROSIS
42214, 42217, 42218, 42219, 42222, 42226, 42228, 42229, 42233, 42235, 42237, 42240, 42259, 42261

NERVOUS SYSTEM
42096, 42104, 42113, 42123, 42127, 42128, 42150, 42163, 42164, 42165, 42174, 42179, 42196

NETHERLANDS
41206, 41366, 41393, 41457, 41498, 41515, 41715, 41760, 41796, 41900, 42126, 42185, 42194

NEUTRAL CONDITION
41975

NEUTRON ACTIVATION ANALYSIS
41697, 41745, 41764, 41868, 42144

NEVADA
42338, 42349

NEW HAMPSHIRE
42335, 42356

NEW JERSEY
42384

NEW YORK CITY
41882, 42156, 42343

NEW YORK STATE
41882, 42156, 42343

NICKEL
41483, 41603, 41632, 42020, 42060, 42282, 42284

NICKEL COMPOUNDS
41631, 41670, 42004, 42146, 42163, 42171, 42175, 42271

NITRATES
41540, 41566, 41574, 41717, 41847, 41856, 41862, 41873, 41879, 41883, 41885, 41894, 41996, 42023, 42026, 42041, 42043, 42054, 42055, 42058, 42062, 42216, 42218, 42219, 42220, 42226, 42230, 42233, 42250, 42255, 42275

NITRIC ACID
41195, 41508, 41563, 41677, 41856, 41919, 41996, 42313

NITRIC ANHYDRIDE (N2O5)
41677

NITRIC OXIDE (NO)
41203, 41236, 41245, 41322, 41355, 41380, 41399, 41413, 41430, 41441, 41448, 41451, 41487, 41494, 41525, 41536, 41560, 41582, 41700, 41704, 41715, 41717, 41722, 41725, 41734, 41739, 41760, 41763, 41774, 41779, 41780, 41788, 41796, 41814, 41848, 41860, 41864, 41879, 41889, 41890, 41899, 41924, 41937, 41945, 41946, 41965, 41979, 41980, 42023, 42027, 42028, 42034, 42036, 42038, 42041, 42043, 42045, 42051, 42059, 42064, 42072, 42364, 42403

NITRITES
42055

NITROGEN
41193, 41291, 41568, 41670, 41723, 41820, 41945, 41996, 42034, 42041, 42076, 42265, 42402

NITROGEN DIOXIDE (NO2)
41231, 41322, 41355, 41369, 41399, 41483, 41559, 41581, 41582, 41596, 41694, 41700, 41701, 41709, 41712, 41715, 41717, 41725, 41739, 41749, 41760, 41774, 41777, 41779, 41794, 41796, 41799, 41812, 41860, 41862, 41864, 41879, 41882, 41889, 41890, 41894, 41899, 41906, 41919, 41924, 41936, 41937, 41945, 41965, 41980, 42023, 42041, 42042, 42043, 42045, 42048, 42054, 42055, 42064, 42094, 42122, 42135, 42138, 42150, 42160, 42183, 42206, 42225, 42226, 42255, 42273, 42341, 42357, 42364, 42380, 42403

NITROGEN ORGANIC COMPOUNDS
41406, 41464, 41514, 41515, 41758, 41811, 41820, 41849, 42025, 42139, 42198

NITROGEN OXIDES
41194, 41197, 41200, 41201, 41203, 41204, 41205, 41206, 41211, 41213, 41217, 41218, 41220, 41225, 41227, 41228, 41229, 41231, 41234, 41236, 41237, 41238, 41239, 41240, 41245, 41248, 41252, 41255, 41257, 41262, 41269, 41274, 41290, 41318, 41322, 41338, 41353, 41354, 41355, 41356, 41364, 41368, 41369, 41380, 41385, 41396, 41399, 41400, 41413, 41421, 41422, 41430, 41441, 41442, 41445, 41448, 41449, 41451, 41463, 41464, 41465, 41466, 41468, 41469, 41473, 41483, 41486, 41487, 41492, 41493, 41494, 41508, 41525, 41536, 41545, 41550, 41551, 41559, 41560, 41563, 41569, 41571, 41573, 41578, 41581, 41582, 41590, 41593, 41596, 41601, 41604, 41612, 41630, 41648, 41677, 41694, 41700, 41701, 41704, 41709, 41710, 41712, 41715, 41717, 41722, 41725, 41734, 41736, 41738, 41739, 41742, 41749, 41760, 41763, 41773, 41774, 41777, 41779, 41780, 41788, 41794, 41796, 41799, 41808, 41812, 41813, 41814, 41816, 41848, 41860, 41861, 41862, 41864, 41875, 41877, 41879, 41882, 41883, 41884, 41886, 41887, 41889, 41890, 41894, 41899, 41906, 41919, 41924, 41926, 41936, 41937, 41945, 41946, 41960, 41965, 41978, 41979, 41980, 41984, 41996, 42000, 42023, 42026, 42027, 42028, 42034, 42036, 42038, 42041, 42042, 42043, 42045, 42048, 42051, 42054, 42055, 42056, 42058, 42059, 42061, 42064, 42066, 42072, 42079, 42092, 42093, 42094, 42121, 42122, 42135, 42138, 42147, 42150, 42156, 42160, 42183, 42206, 42225, 42226, 42250, 42255, 42273, 42282, 42313, 42314, 42316, 42320, 42321, 42323, 42324, 42325, 42326, 42329, 42341, 42357, 42364, 42366, 42367, 42376, 42380, 42382, 42385, 42400, 42402, 42403

NITROUS ACID
41701

NITROUS OXIDE (N2O)
41200, 41318, 41712, 41794, 41945, 42079

NON-METROPOLITAN AREAS
41246, 41252, 41779, 41849, 41867, 41868, 41871, 41895, 41900, 41918, 41994, 41997, 42114, 42172, 42180, 42210, 42258, 42271, 42391, 42404

NORWAY
41600

NOSE
42142

NUCLEAR EXPLOSIONS
41870, 41979, 41981

NUCLEAR POWER
41199, 41576, 41604

NUCLEAR POWER PLANTS
41199, 41215, 41239, 41258, 41367, 41438, 41604, 42293, 42306, 42377

NUCLEATION
41486, 41579, 41782, 41832, 41847, 41919, 41971, 41993, 42009, 42012, 42013, 42017, 42080, 42085, 42091, 42100

NUCLEIC ACIDS
42068, 42131

O

OATS
42238

OCEANS
41200, 41852, 41860, 41927, 41938, 41960, 41985, 41990, 41996

OCTANES
41230, 41556, 42059

ODOR CONTROL
41280, 41291, 41293, 41298, 41300, 41326, 41327, 41341, 41343, 41357, 41370, 41379, 41381, 41383, 41398, 41404, 41406, 41425, 41443, 41493, 41520, 41528, 41605, 41674, 41689

ODOR COUNTERACTION
41280, 41291, 41293, 41298, 41300, 41326, 41327, 41341, 41343, 41357, 41370, 41379, 41381, 41383, 41398, 41404, 41406, 41425, 41443, 41493, 41520, 41528, 41605, 41674, 41689

ODORIMETRY
41787, 41793, 41830

ODOROUS POLLUTANTS
41193, 41262, 41291, 41341, 41357, 41370, 41379, 41400, 41404, 41406, 41422, 41425, 41493, 41499, 41605, 41674, 41689, 41723, 41787, 41793, 41830, 41849, 42018, 42074, 42127, 42323, 42325

OHIO
41867, 41882, 41913, 41918, 42315, 42390

OIL BURNERS
41382, 41472, 41532, 41720

OLEFINS
41278, 41298, 41372, 41746, 41760, 41770, 41882, 41946, 42027, 42042, 42054, 42055, 42061, 42062, 42073, 42190, 42198, 42268, 42273, 42402

OPEN BURNING
41287, 41509, 41868, 42356, 42357

OPERATING CRITERIA
41447, 41468, 41719, 42366

OPERATING VARIABLES
41197, 41204, 41208, 41217, 41218, 41238, 41245, 41262, 41264, 41322, 41352, 41359, 41363, 41364, 41376, 41383, 41424, 41440, 41444, 41452, 41486, 41487, 41509, 41560, 41569, 41581, 41638, 41639, 41643, 41662, 41664, 41667, 41673, 41683, 41715, 41719, 41724, 41729, 41742, 42036, 42079, 42292

OPINION SURVEYS
41287, 42391

OPTICAL METHODS
41769, 41843, 41845, 42152, 42218

OREGON
41868

ORGANIC ACIDS
41277, 41471, 41489, 41670, 41712, 41765, 42074, 42127, 42198, 42252, 42281

ORGANIC WASTES
41327, 41341, 41406, 41528, 41605, 41815, 41830

ORGANOMETALLICS
42162

OSAKA
41378, 41396, 41861, 41948, 42121, 42364

OXIDANTS
41398, 41468, 41700, 41704, 41725, 41739, 41741, 41774, 41812, 41816, 41848, 41854, 41856, 41857, 41864, 41869, 41879, 41880, 41884, 41885, 41886, 41887, 41889, 41921, 41924, 41930, 41935, 41936, 41948, 41950, 41956, 41960, 41978, 42026, 42041, 42056, 42064, 42094, 42101, 42113, 42115, 42132, 42210, 42211, 42212, 42218, 42219, 42222, 42231, 42233, 42234, 42235, 42239, 42241, 42242, 42272, 42273, 42323, 42324, 42330, 42332, 42341, 42352, 42364, 42367, 42379, 42380, 42395

OXIDATION
41223, 41263, 41293, 41353, 41354, 41364, 41398, 41405, 41445, 41471, 41512, 41546, 41596, 41599, 41605, 41628, 41641, 41677, 41695, 41919, 41939, 41955, 41980, 42000, 42027, 42038, 42045, 42052, 42053, 42063, 42122, 42160, 42161, 42280, 42284

OXYGEN
41193, 41202, 41326, 41405, 41413, 41568, 41589, 41670, 41721, 41763, 41808, 41813, 41815, 41945, 42035, 42041, 42045, 42052, 42065, 42067, 42073, 42076, 42117, 42122, 42282, 42400

OXYGEN CONSUMPTION
42175

OXYGEN LANCING
41270

OZONE
41293, 41383, 41398, 41443, 41677, 41683, 41700, 41715, 41725, 41730, 41738, 41760, 41774, 41779, 41794, 41799, 41812, 41848, 41867, 41882, 41922, 41924, 41926, 41928, 41936, 41937, 41939, 41940, 41945, 41946, 41960, 41978, 41980, 41981, 41993, 42000, 42026, 42041, 42058, 42060, 42062, 42065, 42066, 42068, 42094, 42113, 42122, 42125, 42131, 42160, 42161, 42183, 42213, 42217, 42218, 42219, 42220, 42225, 42226, 42227, 42228, 42229, 42232, 42233, 42237, 42240, 42242, 42244, 42245, 42249, 42250, 42252, 42255, 42259, 42265, 42266, 42267, 42268, 42270, 42273, 42385, 42400

P

PACKED TOWERS
41370, 41445, 41622

PAINTS
42285

PAINTS AND ALLIED PRODUCTION
41235, 42238, 42388

PAPER AND ALLIED MANUFACTURING
41208, 41357, 41431, 41434, 41455, 41651, 41674, 41689

PAPER MILLS
41455, 41651

PARIS
41286, 41901, 41902, 41903, 41906, 41907, 41908, 41909, 41910

PARTICLE COUNTING
41747, 41765, 41790, 41834, 41967

PARTICLE GROWTH
41217, 41450, 41629, 41841, 41871, 41897, 41967, 42008, 42011, 42013, 42049, 42062, 42080, 42086, 42088, 42091

PARTICLE INVESTIGATION METHODS
41693, 41717, 41744, 41745, 41747, 41752, 41765, 41790, 41817, 41834, 41840, 41841, 41845, 41847, 41858, 41859, 41865, 41883, 41953, 41967, 42022, 42075, 42158

PARTICLE SEPARATION
41693, 41717, 41744, 41745, 41752, 41817, 41834, 41841, 41847, 41859, 41865

PARTICLE SHAPE
41417, 41454, 41456, 41792, 41841, 41863, 42019, 42024, 42152

PARTICLE SIZE
41223, 41265, 41333, 41363, 41374, 41384, 41390, 41409, 41417, 41429, 41433, 41444, 41456, 41544, 41587, 41613, 41624, 41676, 41685, 41686, 41703, 41707, 41718, 41724, 41737, 41748, 41765, 41790, 41792, 41810, 41819, 41832, 41834, 41836, 41838, 41840, 41841, 41842, 41845, 41848, 41854, 41855, 41858, 41863, 41868, 41871, 41876, 41877, 41882, 41892, 41897, 41911, 41954, 41967, 42004, 42008, 42009, 42012, 42013, 42019, 42022, 42024, 42031, 42032, 42037, 42047, 42062, 42078, 42080, 42081, 42082, 42084, 42085, 42089, 42091, 42152, 42158, 42202, 42385

PARTICULATE CLASSIFICATION METHODS
41818, 41833, 41843, 41982

PARTICULATE SAMPLING
41685, 41707, 41724, 41735, 41744, 41784, 41789, 41818, 41825, 41833, 41841, 41844, 41865, 41871, 41872, 42070

PATHOLOGICAL TECHNIQUES
41607, 42109, 42118, 42122, 42124, 42125, 42137, 42140, 42178, 42181, 42205, 42253

PENNSYLVANIA
41867, 42347

PENTANES
41869

PERFORMANCE STANDARDS
41248, 41254, 41259, 41264, 41323, 41463, 41465, 41466, 41468, 41473, 41492, 41497, 41504, 41535, 41554, 41610, 41612, 41652, 41803, 42312, 42313, 42314, 42316, 42317, 42318, 42319, 42320, 42321, 42322, 42325, 42326, 42328, 42332, 42335, 42338, 42342, 42343, 42345, 42350, 42353, 42354, 42355, 42358, 42361, 42366, 42377, 42381, 42382, 42398

PERMEABILITY
41374, 42136, 42217

PERMITS
42341, 42357

PEROXYACETYL NITRATE
41862, 41873, 42026, 42041, 42055, 42058, 42218, 42219, 42220, 42226, 42230, 42233, 42255, 42275

PEROXYACYL NITRATES
41862, 41873, 42026, 42041, 42043, 42055, 42058, 42218, 42219, 42220, 42226, 42230, 42233, 42250, 42255, 42275

PERSONNEL
41688, 41949, 42156, 42336, 42337, 42340, 42383

PERSONNEL QUALIFICATIONS
42336

PESTICIDES
41195, 41282, 41938, 42139, 42170, 42371, 42404

PETER SPENCE PROCESS (CLAUS)
41280, 41299, 41314, 41320, 41434, 41457, 41485, 41515, 41516, 41531, 41534, 41553

PETROLEUM AND COAL PRODUCTS INDUSTRY
41216, 41235, 41285, 41434, 41462, 41493, 41611, 41634, 41668, 41901, 41902, 41950, 42046, 42059, 42190, 42333

PETROLEUM DISTRIBUTION
41493

PETROLEUM PRODUCTION
41205, 41216, 41235, 41285, 41493, 41617

PETROLEUM REFINING
41216, 41235, 41285, 41434, 41462, 41493, 41611, 41634, 41668, 41901, 41902, 41950, 42046, 42059, 42190, 42333

PH
41316, 41773, 41850, 41854, 41883, 41949, 41955, 41996, 42068, 42240, 42243, 42246, 42292

PHENOLS
41431, 41728, 41758, 41964, 42018, 42127

PHENYL COMPOUNDS
41758, 41927

PHOSPHORIC ACID
42285

PHOSPHORUS COMPOUNDS
41231, 41317, 41323, 41671, 42187

PHOTOCHEMICAL REACTIONS
41770, 41882, 41885, 41919, 41924, 41926, 41930, 41940, 41945, 41948, 41980, 41981, 42008, 42026, 42041, 42042, 42043, 42054, 42055, 42056, 42058, 42061, 42062, 42064, 42065, 42066, 42206, 42364, 42395

PHOTOELECTRIC PHENOMENA
41837, 41945

PHOTOGRAPHIC METHODS
41791, 41797, 42232

PHOTOIONIZATION
42041

PHOTOLYSIS
41945, 42065

PHOTOMETRIC METHODS
41710, 41719, 41741, 41747, 41761, 41777, 41783, 41786, 41792, 41798, 41803, 41824, 41836, 41859, 42238

PHOTOOXIDATION
41919, 41926, 42043, 42064

PHOTOSYNTHESIS
41993, 42275

PHYTOTOXICANTS
41925, 42245, 42249

PILOT PLANTS
41289, 41344, 41354, 41369, 41389, 41403, 41561, 41624

PINTO BEANS
42213, 42232

PLANNING AND ZONING
41239, 41259, 41283, 41284, 41285, 41295, 41316, 41469, 41554, 41893, 42247, 42307, 42308, 42328, 42331, 42365, 42376, 42383, 42397

PLANT DAMAGE
41240, 41246, 41283, 41428, 41791, 41942, 42157, 42209, 42210, 42211, 42214, 42217, 42218, 42219, 42220, 42222, 42226, 42227, 42228, 42229, 42230, 42231, 42232, 42233, 42234, 42235, 42237, 42239, 42240, 42241, 42242, 42243, 42244, 42245, 42249, 42250, 42255, 42257, 42259, 42261, 42262, 42265, 42266, 42267, 42268, 42270, 42271, 42272, 42273, 42274, 42277, 42374, 42403

PLANT GROWTH AND DEVELOPMENT
41295, 41316, 41319, 41942, 41993, 42212, 42214, 42222, 42224, 42236, 42241, 42245, 42254, 42258, 42259, 42263, 42275, 42277

PLANT INDICATORS
41874, 41878, 41982, 42211, 42219, 42232, 42234, 42235, 42236, 42241, 42246, 42251, 42256, 42259, 42266, 42274, 42392

PLASTICS
41256, 41263, 42107

PLATINUM
41353, 41481, 41483, 41533, 41611

PLUME BEHAVIOR
41221, 41276, 41797, 41915, 41932, 41934, 41955, 41957, 41963, 41969, 41977, 41982, 41983, 42073, 42254

PLUTONIUM COMPOUNDS
41333

PNEUMOCONIOSIS
41645, 42097, 42137, 42140, 42152, 42163, 42171, 42176, 42199

PNEUMONIA
41231, 42140

POINT SOURCES
41447, 41894, 41933, 41981, 41982, 41983, 41999, 42007

POLAROGRAPHIC METHODS
41813

POLLENS
41972, 41983, 41989, 41998, 42021

POLYMERIZATION
41526, 42025

POLYNUCLEAR COMPOUNDS
41202, 41863, 41906, 41967, 42126, 42168, 42173, 42179, 42279

POTASSIUM COMPOUNDS
41596, 41605, 41855, 41883, 41997, 42038, 42213, 42217, 42257, 42277

POTENTIOMETRIC METHODS
41710, 41726, 41743

POWER SOURCES
41194, 41196, 41199, 41202, 41203, 41217, 41218, 41219, 41226, 41227, 41228, 41230, 41236, 41237, 41241, 41245, 41248, 41250, 41257, 41261, 41262, 41264, 41268, 41274, 41276, 41283, 41290, 41301, 41313, 41322, 41338, 41346, 41347, 41361, 41368, 41369, 41386, 41400, 41405, 41421, 41422, 41430, 41441, 41442, 41448, 41451, 41462, 41463, 41473, 41474, 41478, 41486, 41487, 41494, 41507, 41512, 41535, 41536, 41550, 41555, 41560, 41573, 41576, 41580, 41582, 41590, 41595, 41601, 41604, 41608, 41610, 41616, 41621, 41626, 41628, 41629, 41632, 41641, 41642, 41643, 41669, 41672, 41761, 41780, 41803, 41813, 41814, 42018, 42036, 42293, 42316, 42326, 42357

PRECIPITATION
41224, 41570, 41773, 41874, 41875, 41883, 41897, 41903, 41909, 41915, 41917, 41933, 41939, 41947, 41949, 41953, 41955, 41971, 41990, 41992, 41996, 41997, 42001, 42002, 42004, 42005, 42006, 42008, 42011, 42012, 42254, 42263, 42290, 42292

PRESSURE (ATMOSPHERIC)
41739, 41948, 41950

PRIMATES (NON-HUMAN)
42097

PROC
42006

PROCESS MODIFICATION
41196, 41199, 41204, 41206, 41208, 41217, 41226, 41236, 41240, 41247, 41270, 41274, 41280, 41286, 41288, 41289, 41302, 41345, 41361, 41369, 41371, 41380, 41385, 41396, 41415, 41427, 41431, 41448, 41449, 41452, 41466, 41469, 41472, 41478, 41486, 41490, 41493, 41494, 41497, 41509, 41511, 41518, 41551, 41560, 41563, 41578, 41579, 41581, 41589, 41594, 41604, 41627, 41652, 41658, 41660, 41661, 41742, 42045, 42403

PROPANES
41494, 41551, 41568, 41760, 41770, 42014, 42054

PROPENES
41278, 41298, 41760, 42042, 42061

PROPIONALDEHYDES
41785

PROPOSALS
42357

PROTEINS
41527, 42099, 42120, 42159, 42168, 42173, 42192, 42194, 42266, 42267

PUBLIC AFFAIRS
41287, 42115, 42333, 42351, 42391

PUBLIC INFORMATION
42351

PULMONARY EDEMA
42392

PULMONARY FUNCTION
42134, 42141, 42155, 42156, 42169, 42176, 42181

PULP MILLS
41208, 41357, 41431, 41434, 41455, 41674, 41689

PULSE RATE
42155

PYRENES
41202, 41863, 41906, 42279

PYRIDINES
42025

PYROLYSIS
41196, 41304, 41393, 41415, 41423, 41431, 41497, 41518, 41596

Q

QUARTZ
41713, 41714

QUESTIONNAIRES
41604, 42142, 42365, 42391

QUINONES
41546

R

RABBITS
41607, 42187, 42208

RADIATION MEASURING SYSTEMS
41828

RADIOACTIVE RADIATION
41239, 41273, 41433, 41703, 41713, 41714, 41745, 41776, 41807, 41828, 41838, 41855, 41870, 41883, 41897, 41971, 42001, 42002, 42004, 42005, 42006, 42034, 42105, 42154, 42256, 42286, 42374, 42400

RADIOACTIVE TRACERS
41675, 41998, 42164, 42165, 42175, 42204, 42213, 42289

RADIOGRAPHY
41714, 42165

RADIOSONDES
42364

RAILROAD VEHICLES
41243, 41257, 41261, 41264, 41957, 42363, 42391

RAIN
41874, 41933, 41939, 41949, 41953, 41955, 41992, 42263, 42290, 42292

RANKINE CYCLE ENGINES
41400, 41473, 41601, 41610

RAPPING
41412, 41460

RATS
42070, 42109, 42118, 42125, 42137, 42139, 42143, 42146, 42147, 42159, 42161, 42164, 42165, 42174, 42175, 42205

REACTION KINETICS
41322, 41364, 41508, 41536, 41558, 41587, 41618, 41675, 41676, 41936, 41939, 41974, 42017, 42023, 42027, 42028, 42033, 42036, 42039, 42045, 42046, 42050, 42052, 42056, 42057, 42061, 42063, 42066, 42073, 42085, 42088, 42118, 42282, 42289, 42292

REACTION MECHANISMS
41322, 41364, 41536, 41558, 41559, 41568, 41675, 41926, 41936, 41974, 42000, 42008, 42023, 42027, 42028, 42035, 42036, 42041, 42043, 42045, 42050, 42052, 42057, 42061, 42063, 42066, 42072, 42073, 42085, 42088, 42250, 42280, 42282, 42289, 42292

REACTORS (NUCLEAR)
41367

RECORDING METHODS
41763, 41791, 41797, 41835, 42232, 42351, 42384

RECREATION AREAS
41895, 42258

REDUCTION
41297, 41332, 41344, 41353, 41354, 41368, 41471, 41508, 41515, 41545, 41550, 41559, 41563, 41630, 42055, 42069, 42122

REFRACTIVE INDEX
41792, 42062, 42084

REFUSE SYSTEMS
41198, 41213, 41235, 41239, 41253, 41256, 41263, 41271, 41287, 41295, 41312, 41316, 41327, 41341, 41343, 41345, 41383, 41406, 41410, 41415, 41416, 41426, 41452, 41467, 41497, 41499, 41506, 41509, 41516, 41518, 41528, 41534, 41563, 41571, 41594, 41595, 41598, 41605, 41617, 41658, 41667, 41742, 41743, 41815, 41830, 41855, 41933, 42281, 42301, 42325, 42379, 42391

REGULATIONS
41204, 41254, 41283, 41284, 41496, 41652, 41874, 42064, 42303, 42313, 42314, 42319, 42320, 42321, 42322, 42326, 42328, 42330, 42333, 42334, 42335, 42338, 42341, 42343, 42345, 42349, 42350, 42356, 42357, 42360, 42361, 42362, 42367, 42368, 42376, 42380, 42387

REPRODUCTION (BIOLOGICAL)
41607, 42143, 42157

RESEARCH INSTITUTES
42337

RESEARCH METHODOLOGIES
41257, 41294, 41376, 41591, 41688, 41977, 42093, 42097, 42232

RESEARCH PROGRAMS
41276, 41331, 41354, 41436, 41688, 41707, 41782, 41807, 41814, 42324, 42337, 42369, 42372, 42385, 42388, 42396

RESIDENTIAL AREAS
41202, 41285, 41848, 41895, 41900, 41937, 42104, 42214, 42233, 42236, 42258, 42308

RESIDUAL OILS
41272, 41273, 41418, 41462, 41578, 41631, 41721, 42377, 42379

RESPIRATION (PLANTS)
42267

RESPIRATORY DISEASES
41231, 41645, 42092, 42093, 42095, 42097, 42098, 42101, 42105, 42106, 42107, 42108, 42110, 42111, 42112, 42113, 42119, 42121, 42132, 42133, 42134, 42137, 42138, 42140, 42142, 42145, 42147, 42150, 42152, 42154, 42158, 42160, 42163, 42167, 42171, 42176, 42179, 42180, 42182, 42183, 42184, 42199, 42392, 42403

RESPIRATORY SYSTEM
41231, 41255, 42070, 42094, 42103, 42112, 42118, 42119, 42122, 42124, 42125, 42131, 42136, 42137, 42140, 42141, 42142, 42145, 42148, 42152, 42160, 42161, 42172, 42183, 42199, 42201, 42204, 42253, 42278

RETENTION
42044, 42052, 42104, 42118, 42129, 42145, 42148, 42164, 42165, 42170, 42171, 42174, 42177, 42188, 42208, 42216, 42223, 42258, 42263, 42271, 42277, 42289

RHODE ISLAND
42334, 42344

RIVERS
41996

ROADS
41202, 41283, 41855, 41872, 41874, 41884, 41888, 41895, 41899, 41900, 41937, 41954, 41961, 41969, 42155, 42156, 42221, 42247, 42271, 42341, 42363

ROTARY ENGINES
41230, 41274, 41301, 41474, 41610, 41643, 42326

ROTARY PISTON ENGINES
41230, 41274, 41301, 41474, 41610, 41643, 42326

S

SALTZMAN METHOD (NOX)
41701, 41742, 41743, 41777, 41889

SAMPLERS
41645, 41696, 41706, 41707, 41711, 41716, 41735, 41744, 41774, 41784, 41789, 41815, 41825, 41844, 41846, 41872, 41892, 42081

SAMPLING PROBES
41688, 41693, 41710, 41780, 41781, 41815, 41839

SANITARY SERVICES
41198, 41213, 41235, 41239, 41253, 41254, 41256, 41263, 41271, 41282, 41287, 41295, 41298, 41312, 41316, 41326, 41327, 41341, 41343, 41345, 41383, 41391, 41406, 41410, 41415, 41416, 41425, 41426, 41433, 41452, 41467, 41497, 41499, 41506, 41509, 41516, 41518, 41528, 41534, 41563, 41571, 41585, 41594, 41595, 41598, 41605, 41615, 41617, 41658, 41667, 41742, 41743, 41815, 41830, 41855, 41933, 42281, 42301, 42325, 42379, 42391

SCANDINAVIA
41224, 41282, 41292, 41308, 41359, 41511, 41600, 41607, 41656, 41737, 41761, 41786, 41787, 41917, 41938, 41996, 42106, 42119, 42246, 42256, 42274, 42377

SCATTERING (ATMOSPHERIC)
41276, 41727, 41953

SCREEN FILTERS
41329, 41688

SCRUBBERS
41231, 41244, 41253, 41254, 41270, 41277, 41291, 41297, 41307, 41308, 41312, 41320, 41326, 41328, 41332, 41342, 41343, 41348, 41351, 41354, 41357, 41359, 41363, 41364, 41370, 41383, 41384, 41387, 41390, 41391, 41392, 41411, 41416, 41424, 41426, 41429, 41432, 41433, 41445, 41447, 41450, 41467, 41475, 41479, 41484, 41485, 41489, 41499, 41501, 41503, 41510, 41513, 41517, 41519, 41520, 41524, 41534, 41543, 41545, 41546, 41547, 41553, 41561, 41563, 41567, 41572, 41585, 41597, 41605, 41615, 41620, 41622, 41624, 41625, 41633, 41635, 41636, 41640, 41647, 41650, 41651, 41653, 41655, 41663, 41664, 41665, 41666, 41673, 41676, 41680, 41728, 42281, 42305

SEA BREEZE
41881, 41921, 41922, 41927, 41930, 41950, 41978

SEA SALTS
41865

SECONDARY AIR
41236, 41247

SEDIMENTATION
41629, 41841

SEDIMENTATION (CONTROL)
41375, 41390, 41544, 41685, 41724, 41897

SELENIUM COMPOUNDS
41883, 42137

SETTLING PARTICLES
41193, 41195, 41197, 41202, 41204, 41205, 41217, 41222, 41223, 41225, 41231, 41239, 41245, 41247, 41253, 41255, 41256, 41270, 41271, 41281, 41286, 41289, 41321, 41329, 41330, 41341, 41349, 41358, 41363, 41370, 41371, 41378, 41380, 41382, 41404, 41411, 41416, 41419, 41429, 41437, 41439, 41444, 41450, 41454, 41460, 41462, 41470, 41493, 41500, 41506, 41538, 41539, 41543, 41545, 41547, 41571, 41578, 41598, 41600, 41619, 41620, 41622, 41624, 41627, 41635, 41639, 41645, 41656, 41657, 41662, 41663, 41679, 41681, 41684, 41686, 41687, 41688, 41691, 41707, 41713, 41714, 41727, 41736, 41738, 41739, 41742, 41743, 41745, 41747, 41754, 41765, 41766, 41784, 41786, 41789, 41818, 41824, 41842, 41850, 41853, 41856, 41859, 41861, 41863, 41865, 41872, 41877, 41878, 41879, 41881, 41883, 41891, 41898, 41899, 41904, 41906, 41964, 41986, 41990, 41995, 42005, 42014, 42015, 42039, 42030, 42090, 42093, 42104, 42105, 42106, 42107, 42112, 42119, 42135, 42136, 42137, 42140, 42145, 42172, 42176, 42180, 42184, 42199, 42205, 42207, 42221, 42222, 42236, 42253, 42258,

42279, 42283, 42311, 42312, 42364, 42379, 42392, 42398

SEWAGE TREATMENT
41282, 41298

SEWERAGE SYSTEMS
41198, 41253, 41254, 41282, 41298, 41326, 41391, 41406, 41425, 41433, 41585, 41605, 41615, 42391

SILICATES
41349, 41399, 41481, 41488, 42033

SILICON COMPOUNDS
41349, 41399, 41481, 41488, 41513, 42033

SILICON DIOXIDE
41453, 41595, 41997, 42171, 42205, 42253

SILICOSIS
42097, 42199

SIMULATION
41203, 41266, 41269, 41346, 41448, 41474, 41544, 41560, 41591, 41939, 41952, 41977, 41981, 41984, 41991, 42061, 42362

SINTERING
41335, 41434

SINUSES
42142

SKIN (ANATOMY)
42135

SLUDGE
41198, 41253, 41254, 41282, 41326, 41391, 41433, 41585, 41605, 41615

SMOG
41301, 41723, 41736, 41848, 41854, 41855, 41862, 41869, 41879, 41880, 41881, 41884, 41885, 41909, 41924, 41930, 41948, 41950, 42026, 42041, 42043, 42058, 42061, 42062, 42064, 42101, 42113, 42115, 42183, 42210, 42226, 42231, 42330, 42379, 42394, 42395, 42403

SMOKE SHADE
41257, 41761, 41788

SMOKEMETERS
41437, 41778, 41803

SMOKES
41213, 41215, 41227, 41228, 41239, 41247, 41262, 41268, 41276, 41311, 41369, 41437, 41467, 41470, 41486, 41488, 41493, 41499, 41506, 41532, 41539, 41551, 41594, 41617, 41743, 41761, 41766, 41778, 41803, 41808, 41814, 41829, 41883, 41901, 41902, 41903, 41907, 41908, 41910, 41985, 42017, 42018, 42098, 42110, 42119, 42150, 42181, 42248, 42279, 42316, 42322, 42391, 42399

SMOKING
41607, 42102, 42110, 42130, 42147, 42153, 42156, 42167, 42180, 42193, 42269, 42279

SNOW
41224, 41947, 41971

SOCIAL ATTITUDES
42391

SOCIO-ECONOMIC FACTORS
41199, 41201, 41211, 41233, 41260, 41303, 41345, 41374, 41408, 41482, 41988, 42106, 42128, 42157, 42293, 42294, 42295, 42298, 42299, 42300, 42301, 42302, 42304, 42306, 42307, 42308, 42310, 42366, 42381, 42401

SODIUM CARBONATE
41666

SODIUM CHLORIDE
42290

SODIUM COMPOUNDS
41308, 41320, 41342, 41349, 41365, 41488, 41595, 41596, 41622, 41666, 41694, 41997, 42191, 42198, 42277, 42285, 42290

SODIUM HYDROXIDE
41365, 41596, 41622

SODIUM SULFITE
41342

SOILING INDEX
41824, 41875, 41913

SOILS
41200, 41243, 41282, 41295, 41316, 41319, 41343, 41413, 41745, 41756, 41855, 41874, 41878, 41898, 41933, 41938, 41960, 41980, 41996, 42212, 42223, 42224, 42243, 42247, 42260, 42263, 42264, 42271, 42392

SOLAR RADIATION
41276, 41564, 41749, 41915, 41921, 41929, 41931, 41935, 41951, 41953, 41956, 41973, 41985, 41986, 42010, 42054, 42055, 42062

SOLVENT REFINING
41304, 41506

SOLVENTS
41209, 41304, 41426, 41491, 41652, 41667, 41820, 42064, 42206, 42313, 42330, 42343

SOOT
41197, 41204, 41217, 41247, 41256, 41286, 41341, 41371, 41380, 41571, 41656, 41679, 41738, 41747, 41904, 42014, 42039, 42050, 42279, 42282, 42398

SOURCE MONITORING
41332, 41688, 41710, 41719, 41721, 41751, 41755, 41764, 41788, 41808, 41815, 41822, 41839

SOUTH AMERICA
41318, 41860

SOUTH PACIFIC
41297, 41386, 41408, 41940, 41959, 41963, 42016, 42047, 42296, 42301, 42397

SOX CONTROL
41204, 41231, 41234, 41254, 41275, 41280, 41292, 41297, 41299, 41308, 41309, 41312, 41314, 41319, 41320, 41332, 41336, 41344, 41350, 41352, 41360, 41387, 41389, 41391, 41418, 41431, 41433, 41434, 41445, 41457, 41460, 41462, 41469, 41471, 41475, 41482, 41484, 41485, 41486, 41488, 41490, 41502, 41503, 41510, 41515, 41516, 41517, 41521, 41531, 41534, 41539, 41545, 41546, 41549, 41553, 41561, 41571, 41578, 41587, 41598, 41604, 41622, 41627, 41665, 41675, 41963, 42297, 42300, 42303, 42305, 42312, 42401

SPARK IGNITION ENGINES
41219, 41274, 41283, 41290, 41347, 41421, 41422, 41474, 41486, 41494

SPARK TIMING
41355, 41356, 41448, 41466, 41494, 41542, 41593, 42320

SPECTROMETRY
41202, 41690, 41692, 41699, 41703, 41704, 41708, 41710, 41712, 41717, 41718, 41719, 41722, 41723, 41725, 41730, 41736, 41738, 41742, 41746, 41748, 41749, 41752, 41755, 41756, 41757, 41764, 41769, 41776, 41785, 41788, 41796, 41814, 41821, 41822, 41831, 41833, 42018, 42034, 42054, 42063, 42068, 42076, 42078

SPECTROPHOTOMETRY
41693, 41716, 41728, 41735, 41753, 41762, 41764, 41769, 41785, 41889, 42048, 42173

SPINACH
42216, 42235, 42240

SPORES
41989, 42021, 42078, 42107

SPRAY TOWERS
41467, 41519, 4162[illegible], 41635, 41636, 41647, 41676

SPRAYS
41245, 41419, 41437, 41450

ST LOUIS
41918, 41920, 41961, 42102

STABILITY (ATMOSPHERIC)
41564, 41724, 41727, 41881, 41914, 41915, 41918, 41921, 41924, 41930, 41934, 41935, 41936, 41946, 41947, 41948, 41950, 41952, 41956, 41957, 41970, 41975, 41977, 42001, 42007, 42009, 42167, 42364

STACK GASES
41193, 41198, 41204, 41206, 41208, 41213, 41215, 41216, 41221, 41222, 41231, 41234, 41238, 41239, 41251, 41252, 41253, 41254, 41263, 41270, 41271, 41275, 41277, 41278, 41279, 41280, 41286, 41289, 41291, 41292, 41293, 41297, 41299, 41302, 41307, 41308, 41310, 41312, 41319, 41320, 41326, 41328, 41332, 41336, 41340, 41341, 41345, 41350, 41351, 41352, 41354, 41358, 41359, 41364, 41370, 41371, 41381, 41382, 41383, 41384, 41387, 41389, 41391, 41395, 41399, 41401, 41407, 41411, 41413, 41416, 41418, 41423, 41428, 41432, 41433, 41437, 41444, 41445, 41450, 41452, 41453, 41454, 41457, 41460, 41462, 41469, 41475, 41476, 41479, 41481, 41482, 41484, 41485, 41488, 41489, 41490, 41491, 41493, 41495, 41496, 41499, 41501, 41502, 41503, 41505, 41508, 41510, 41513, 41514, 41515, 41516, 41517, 41519, 41520, 41521, 41523, 41524, 41532, 41534, 41539, 41540, 41545, 41546, 41547, 41549, 41553, 41558, 41559, 41561, 41563, 41567, 41570, 41571, 41572, 41574, 41578, 41584, 41585, 41587, 41588, 41592, 41594, 41600, 41604, 41605, 41613, 41615, 41619, 41620, 41622, 41623, 41624, 41625, 41626, 41627, 41635, 41638, 41644, 41649, 41651, 41653, 41656, 41663, 41664, 41668, 41670, 41672, 41673, 41674, 41675, 41680, 41685, 41688, 41690, 41693, 41701, 41712, 41719, 41720, 41721, 41739, 41742, 41743, 41751, 41755, 41763, 41766, 41771, 41778, 41781, 41784, 41808, 41809, 41815, 41816, 41839, 41845, 41866, 41878, 41898, 41909, 41914, 41932, 41955, 41989, 41990, 42073, 42096, 42278, 42279, 42281, 42297, 42303, 42305, 42312, 42313, 42328, 42332, 42350, 42354, 42362, 42374, 42380, 42391, 42393, 42398, 42401

STACK MONITORING
41332, 41688, 41710, 41719, 41721, 41751, 41755, 41788, 41808, 41815, 41839

STACKS
41286, 41302, 41334, 41469, 41493, 41554, 41598, 41604, 41963, 42305, 42312, 42374, 42393, 42401

STATE GOVERNMENTS
42318, 42325, 42339, 42367, 42371, 42376

STATIONARY EMISSION SOURCES
41193, 41196, 41198, 41199, 41202, 41204, 41205, 41206, 41207, 41208, 41209, 41210, 41211, 41213, 41215, 41216, 41217, 41218, 41219, 41221, 41222, 41223, 41230, 41231, 41232, 41234, 41235, 41237, 41238, 41239, 41240, 41243, 41244, 41246, 41247, 41249, 41250, 41251, 41252, 41253, 41254, 41255, 41256, 41258, 41260, 41263, 41264, 41265, 41270, 41271, 41272, 41273, 41277, 41279, 41282, 41285, 41287, 41289, 41291, 41295, 41296, 41297, 41298, 41300, 41302, 41303, 41304, 41306, 41307, 41308, 41310, 41311, 41312, 41316, 41319, 41321, 41322, 41323, 41324, 41326, 41327, 41332, 41335, 41338, 41340, 41341, 41343, 41345, 41347, 41349,

41351, 41352, 41357, 41360, 41361, 41366, 41367, 41371, 41373, 41374, 41379, 41382, 41383, 41385, 41388, 41389, 41391, 41392, 41394, 41396, 41397, 41401, 41403, 41406, 41407, 41408, 41409, 41410, 41412, 41415, 41416, 41418, 41420, 41421, 41422, 41423, 41424, 41425, 41426, 41427, 41428, 41431, 41433, 41434, 41435, 41438, 41439, 41444, 41445, 41450, 41452, 41454, 41455, 41462, 41465, 41467, 41468, 41469, 41470, 41472, 41474, 41479, 41480, 41484, 41486, 41489, 41491, 41492, 41493, 41494, 41497, 41499, 41503, 41505, 41506, 41509, 41513, 41516, 41517, 41518, 41520, 41521, 41522, 41524, 41528, 41529, 41530, 41532, 41533, 41534, 41545, 41551, 41553, 41554, 41556, 41560, 41561, 41562, 41563, 41567, 41569, 41570, 41571, 41576, 41578, 41579, 41580, 41581, 41585, 41587, 41588, 41589, 41591, 41594, 41595, 41596, 41597, 41598, 41602, 41604, 41605, 41608, 41611, 41615, 41617, 41620, 41622, 41623, 41624, 41626, 41627, 41631, 41634, 41635, 41640, 41644, 41645, 41648, 41651, 41652, 41658, 41659, 41660, 41661, 41662, 41664, 41665, 41667, 41668, 41671, 41674, 41678, 41679, 41680, 41686, 41689, 41707, 41717, 41719, 41720, 41721, 41739, 41742, 41743, 41745, 41751, 41756, 41763, 41764, 41769, 41808, 41815, 41830, 41849, 41853, 41855, 41858, 41859, 41861, 41863, 41865, 41868, 41870, 41871, 41874, 41877, 41883, 41885, 41898, 41901, 41902, 41904, 41909, 41915, 41925, 41932, 41933, 41950, 41955, 41957, 41973, 41979, 41981, 41986, 41990, 42045, 42046, 42047, 42057, 42059, 42076, 42092, 42135, 42145, 42150, 42151, 42158, 42163, 42168, 42171, 42173, 42179, 42181, 42189, 42190, 42193, 42200, 42207, 42215, 42223, 42238, 42243, 42254, 42260, 42278, 42281, 42293, 42294, 42295, 42296, 42298, 42300, 42301, 42305, 42306, 42309, 42312, 42313, 42318, 42320, 42325, 42326, 42328, 42330, 42332, 42333, 42334, 42339, 42350, 42356, 42357, 42360, 42362, 42363, 42366, 42370, 42371, 42372, 42373, 42374, 42376, 42377, 42379, 42387, 42388, 42391, 42393, 42397, 42398, 42399, 42403, 42405

STATISTICAL ANALYSES
41714, 41721, 41736, 41739, 41740, 41742, 41747, 41795, 41807, 41824, 41848, 41857, 41858, 41879, 41896, 41935, 41940, 41952, 41962, 41964, 41965, 41978, 41982, 41995, 42013, 42040, 42047, 42100, 42121, 42149, 42156, 42158, 42201, 42204, 42232, 42245, 42248, 42292, 42307, 42308, 42395

STEAM
41221, 41236, 41357, 41589

STEAM ELECTRIC POWER GENERATION
41199, 41215, 41222, 41244, 41254, 41265, 41303, 41306, 41308, 41319, 41332, 41361, 41373, 41374, 41382, 41388, 41389, 41391, 41403, 41409, 41433, 41435, 41472, 41480, 41505, 41562, 41567, 41578, 41581, 41627, 41659, 41662, 41664, 41764, 41909, 41932, 41955, 41957, 42305, 42306

STEAM ENGINES
41400, 41473, 41601, 41610

STEEL
41207, 41275, 41288, 41310, 41405, 41445, 41447, 41619, 41630, 41664, 41913, 41995, 42092, 42282, 42283

STONE
41454, 42286

STRATIFIED CHARGE ENGINES
41226, 41248, 41400, 41430, 41451, 41487, 41536, 41610, 42326

STREETS
41283, 41884, 41888, 41895, 41899, 41900, 41961, 42155, 42156, 42221, 42247, 42271, 42363

STRONTIUM COMPOUNDS
41855

STRUCTURES
41242, 41378, 41872, 41893, 41895, 41962, 41977, 42156, 42210, 42219, 42224, 42240, 42244

STUDENTS
41949

SUBSURFACE STRUCTURES
41242, 41872, 41895, 42156

SULFATES
41234, 41254, 41314, 41319, 41342, 41453, 41460, 41504, 41528, 41529, 41553, 41773, 41823, 41847, 41852, 41856, 41879, 41882, 41883, 41894, 41923, 41929, 41939, 41955, 41960, 41980, 42005, 42062, 42095, 42108, 42149, 42243, 42263, 42280, 42285, 42286

SULFATION-OF-LEAD METHODS
41823

SULFHYDRYL COMPOUNDS
41291, 42217, 42266, 42267

SULFIDES
41280, 41291, 41299, 41312, 41314, 41336, 41357, 41360, 41401, 41471, 41479, 41485, 41489, 41493, 41529, 41531, 41534, 41545, 41546, 41553, 41588, 41600, 41603, 41611, 41678, 41698, 41700, 41712, 41759, 41750, 41763, 41779, 41794, 41798, 41849, 41926, 41929, 41960, 42039, 42041, 42163, 42282, 42291

SULFITES
41254, 41319, 41505, 41553, 41651, 42286

SULFUR COMPOUNDS
41202, 41212, 41223, 41234, 41240, 41243, 41254, 41280, 41291, 41299, 41312, 41314, 41319, 41323, 41336, 41342, 41344, 41352, 41357, 41360, 41372, 41394, 41401, 41407, 41438, 41453, 41460, 41468, 41471, 41479, 41482, 41485, 41489, 41493, 41504, 41505, 41506, 41515, 41522, 41528, 41529, 41531, 41534, 41539, 41545, 41546, 41553, 41578, 41588, 41595, 41598, 41600, 41602, 41603, 41611, 41651, 41678, 41698, 41700, 41712, 41739, 41759, 41760, 41763, 41773, 41779, 41781, 41794, 41798, 41823, 41847, 41849, 41852, 41855, 41856, 41863, 41879, 41882, 41883, 41894, 41923, 41926, 41929, 41939, 41954, 41955, 41960, 41980, 41996, 42005, 42039, 42041, 42047, 42062, 42063, 42076, 42095, 42108, 42149, 42163, 42243, 42260, 42263, 42280, 42282, 42285, 42286, 42291, 42292, 42303, 42334, 42379, 42400, 42402

SULFUR DIOXIDE
41193, 41197, 41201, 41205, 41207, 41208, 41215, 41225, 41252, 41275, 41280, 41286, 41302, 41336, 41345, 41360, 41378, 41462, 41471, 41486, 41490, 41493, 41504, 41596, 41600, 41627, 41638, 41690, 41693, 41695, 41698, 41700, 41710, 41719, 41721, 41739, 41742, 41749, 41750, 41751, 41753, 41755, 41760, 41763, 41771, 41773, 41774, 41779, 41781, 41788, 41791, 41794, 41796, 41799, 41808, 41812, 41816, 41823, 41852, 41853, 41854, 41857, 41860, 41861, 41866, 41875, 41879, 41882, 41883, 41884, 41886, 41889, 41894, 41896, 41903, 41909, 41913, 41919, 41923, 41929, 41932, 41936, 41939, 41942, 41947, 41955, 41957, 41960, 41962, 41963, 41964, 41965, 41984, 41993, 41994, 41996, 42025, 42030, 42033, 42035, 42039, 42041, 42042, 42043, 42052, 42053, 42057, 42062, 42063, 42067, 42069, 42092, 42093, 42096, 42098, 42108, 42119, 42121, 42124, 42150, 42160, 42167, 42227, 42229, 42236, 42243, 42246, 42248, 42250, 42255, 42257, 42259, 42261, 42270, 42273, 42280, 42281, 42282, 42283, 42286, 42287, 42288, 42289, 42290, 42291, 42295, 42305, 42306, 42323, 42324, 42335, 42344, 42357, 42361, 42362, 42364, 42390, 42398, 42399

SULFUR ORGANIC COMPOUNDS
41202, 41291, 41357, 41493, 41759, 41849, 42046, 42217, 42266, 42267, 42291

SULFUR OXIDES
41193, 41197, 41201, 41205, 41207, 41208, 41215, 41225, 41231, 41239, 41241, 41252, 41275, 41280, 41286, 41302, 41328, 41336, 41345, 41351, 41360, 41378, 41396, 41462, 41468, 41471, 41486, 41490, 41493, 41495, 41501, 41502, 41504, 41516, 41532, 41545, 41596, 41600, 41604, 41627, 41638, 41690, 41693, 41695, 41698, 41700, 41710, 41719, 41721, 41736, 41738, 41739, 41742, 41743, 41749, 41750, 41751, 41753, 41754, 41755, 41760, 41763, 41771, 41773, 41774, 41779, 41781, 41788, 41791, 41794, 41796, 41799, 41808, 41812, 41816, 41823, 41850, 41852, 41853, 41854, 41857, 41860, 41861, 41866, 41875, 41877, 41879, 41881, 41882, 41883, 41884, 41886, 41889, 41890, 41894, 41896, 41899, 41903, 41909, 41913, 41919, 41923, 41929, 41932, 41936, 41939, 41942, 41947, 41955, 41957, 41960, 41962, 41963, 41964, 41965, 41978, 41984, 41993, 41994, 41996, 42025, 42030, 42033, 42035, 42039, 42041, 42042, 42043, 42052, 42053, 42057, 42059, 42062, 42063, 42067, 42069, 42092, 42093, 42096, 42098, 42108, 42119, 42121, 42124, 42147, 42150, 42160, 42167, 42222, 42227, 42229, 42236, 42243, 42246, 42248, 42250, 42255, 42257, 42259, 42261, 42270, 42273, 42280, 42281, 42282, 42283, 42286, 42287, 42288, 42289, 42290, 42291, 42295, 42303, 42305, 42306, 42310, 42322, 42323, 42324, 42325, 42332, 42335, 42344, 42345, 42352, 42357, 42361, 42362, 42364, 42366, 42370, 42376, 42379, 42380, 42390, 42398, 42399, 42401, 42402

SULFUR TRIOXIDE
41231, 41286, 41328, 41351, 41495, 41501, 41502, 41516, 41532, 41600, 41627, 41710, 41881, 42052, 42063, 42281, 42291, 42303

SULFURIC ACID
41195, 41231, 41234, 41292, 41312, 41328, 41342, 41352, 41389, 41392, 41434, 41471, 41495, 41501, 41502, 41505, 41513, 41516, 41521, 41522, 41613, 41627, 41762, 41781, 41856, 41919, 41996, 42095, 42243, 42285, 42291

SUPERSATURATION
42080

SURFACE COATING OPERATIONS
41213, 41426, 41450, 41644, 41652, 41658, 41660, 41661, 41667, 42135, 42238, 42330, 42387, 42388

SURFACE COATINGS
41233, 41426, 41652, 41658, 41660, 41661, 42285, 42387

SURFACE PROPERTIES
41526, 42011, 42016, 42025, 42033, 42051, 42071, 42079, 42085, 42291

SURFACTANTS
41349, 41629

SURVEY METHODS
41731, 41799, 41857, 41875, 41889, 41969, 42093, 42337, 42364, 42373, 42384, 42391

SUSPENDED PARTICULATES
41193, 41196, 41213, 41215, 41227, 41228, 41239, 41247, 41249, 41253, 41262, 41268, 41272, 41273, 41276, 41295, 41296, 41301, 41303, 41306, 41307, 41311, 41316, 41331, 41332, 41339, 41358, 41359, 41367, 41369, 41370, 41374, 41377, 41379, 41382, 41388, 41389, 41391, 41392, 41403, 41408, 41409, 41410, 41417, 41425, 41433, 41435, 41436,

41437, 41450, 41455, 41456, 41467, 41470, 41480, 41486, 41488, 41493, 41495, 41499, 41506, 41532, 41539, 41551, 41586, 41587, 41594, 41600, 41613, 41617, 41625, 41636, 41647, 41659, 41676, 41680, 41716, 41719, 41723, 41727, 41733, 41736, 41743, 41744, 41756, 41761, 41766, 41778, 41803, 41808, 41814, 41819, 41829, 41845, 41848, 41854, 41855, 41856, 41861, 41862, 41863, 41869, 41872, 41879, 41880, 41881, 41883, 41884, 41885, 41886, 41889, 41890, 41894, 41898, 41901, 41902, 41903, 41904, 41907, 41908, 41909, 41910, 41924, 41925, 41930, 41948, 41950, 41953, 41972, 41983, 41985, 41989, 41998, 42017, 42018, 42021, 42026, 42041, 42043, 42044, 42047, 42058, 42061, 42062, 42064, 42085, 42087, 42088, 42092, 42098, 42101, 42108, 42110, 42113, 42115, 42119, 42149, 42150, 42181, 42183, 42210, 42224, 42226, 42231, 42248, 42279, 42294, 42316, 42322, 42323, 42330, 42366, 42379, 42380, 42391, 42392, 42394, 42395, 42399, 42403

SWEDEN
41224, 41282, 41292, 41308, 41359, 41511, 41737, 41761, 41786, 41787, 41917, 41938, 41996, 42119, 42256, 42274, 42377

SYNERGISM
41844, 42105, 42119, 42123, 42132, 42143, 42146, 42157, 42160, 42226, 42245, 42270

SYNTHETIC FIBERS
41538, 41681, 42107

T

TAR (MATERIAL)
41863

TAXATION
42296, 42391

TECHNICAL SOCIETIES
42372

TEMPERATURE
41198, 41203, 41240, 41263, 41268, 41288, 41297, 41311, 41318, 41323, 41325, 41405, 41413, 41457, 41481, 41523, 41560, 41565, 41587, 41622, 41630, 41649, 41653, 41654, 41667, 41979, 42020, 42022, 42033, 42039, 42045, 42052, 42056, 42057, 42117, 42284, 42292

TEMPERATURE (ATMOSPHERIC)
41564, 41875, 41893, 41918, 41922, 41935, 41950, 41953, 41956, 41960, 41964, 41965, 41970, 41973, 41975, 41986, 41991, 41997, 42000, 42003, 42102, 42167, 42180, 42254, 42257, 42282, 42290, 42362, 42364

TEMPERATURE GRADIENT
41724, 41915, 41918, 41970, 42364

TENSILE STRENGTH
41374

TEST ENGINES
41376, 41440

TEXTILE MILLS
41209, 41597, 41769

TEXTILES
41538, 41681, 41769, 42107, 42403

THERMAL RADIATION
41199, 41239, 41626, 41920, 41966

THERMODYNAMICS
41508, 41642, 41724, 42008, 42017, 42027, 42030, 42035, 42082, 42083, 42085

THIN-LAYER CHROMATOGRAPHY
41699

THIOPHENE
41202

THRESHOLDS
41793, 42031, 42108, 42123, 42127, 42138, 42160, 42161, 42177, 42190, 42215, 42242, 42362

TIMED FUEL INJECTION
41237, 41614

TIN
41483

TIN COMPOUNDS
41450

TISSUE CULTURES
42136, 42159

TISSUES
41756, 42109, 42112, 42140, 42178, 42188, 42253

TITANIUM
42281

TITANIUM COMPOUNDS
41855, 42069

TOBACCO
42211, 42242, 42245, 42252, 42265, 42266, 42267, 42268, 42269, 42270, 42279

TOKYO
41213, 41225, 41378, 41736, 41802, 41848, 41857, 41864, 41873, 41886, 41887, 41889, 41890, 41921, 41922, 41935, 41937, 41948, 41965, 42026, 42101, 42115, 42154, 42182, 42214, 42222, 42231, 42233, 42235, 42299, 42332

TOLUENES
41230

TOMATOES
42245

TOPOGRAPHIC INTERACTIONS
41564, 41861, 41881, 41893, 41922, 41932, 41937, 41950, 41957, 41961, 41969, 41970, 41976, 41977, 41987, 41991, 41994

TOXIC TOLERANCES
42094, 42105, 42220, 42226, 42228, 42241, 42242, 42244, 42251, 42258, 42259, 42261, 42262, 42270, 42273

TOXICITY
41233, 41246, 41256, 41284, 41319, 41332, 41607, 41645, 41817, 41844, 41958, 41963, 41989, 42094, 42095, 42097, 42099, 42100, 42107, 42109, 42113, 42114, 42119, 42131, 42132, 42136, 42139, 42141, 42143, 42150, 42151, 42155, 42157, 42159, 42160, 42161, 42162, 42177, 42181, 42185, 42187, 42189, 42192, 42194, 42201, 42207, 42208, 42215, 42226, 42232, 42242, 42244, 42245, 42250, 42255, 42257, 42259, 42262, 42270, 42271, 42273, 42304, 42326, 42369, 42392, 42402, 42403, 42404, 42405

TRACE ANALYSIS
41692, 41712, 41726, 41744, 41745, 41752, 41756, 41764, 41798, 41819, 41860, 41868, 41883, 41891, 41997, 42144, 42392

TRACERS
41675, 41782, 41981, 41982, 41991, 41998, 42164, 42165, 42175, 42204, 42213, 42289, 42364

TRANSPORT
41272, 41285, 41618, 41782, 41867, 41874, 41883, 41917, 41924, 41927, 41933, 41937, 41941, 41942, 41943, 41944, 41945, 41947, 41948, 41959, 41960, 41961, 41975, 41977, 41982, 41989, 41990, 42012, 42017, 42021, 42066, 42071, 42083, 42114, 42117, 42157, 42213, 42243, 42404

TRANSPORTATION METHODS
41194, 41197, 41201, 41211, 41214, 41220, 41225, 41227, 41228, 41229, 41230, 41234, 41236, 41237, 41242, 41243, 41248, 41252, 41257, 41259, 41261, 41262, 41264, 41266, 41267, 41269, 41274, 41276, 41281, 41283, 41284, 41309, 41315, 41323, 41324, 41338, 41340, 41353, 41355, 41356, 41358, 41366, 41372, 41396, 41400, 41405, 41414, 41420, 41421, 41425, 41430, 41449, 41461, 41462, 41463, 41464, 41465, 41466, 41468, 41474, 41483, 41486, 41492, 41493, 41499, 41504, 41511, 41512, 41525, 41535, 41541, 41542, 41551, 41560, 41565, 41566, 41573, 41580, 41582, 41593, 41599, 41601, 41608, 41616, 41621, 41626, 41630, 41642, 41645, 41646, 41648, 41669, 41722, 41747, 41757, 41767, 41768, 41770, 41782, 41785, 41813, 41814, 41837, 41851, 41854, 41855, 41862, 41871, 41872, 41874, 41882, 41883, 41884, 41885, 41887, 41888, 41889, 41890, 41893, 41895, 41899, 41905, 41906, 41924, 41930, 41937, 41954, 41957, 41960, 41965, 41969, 41976, 41979, 41985, 42000, 42054, 42055, 42056, 42058, 42059, 42072, 42179, 42211, 42221, 42247, 42260, 42271, 42314, 42316, 42319, 42320, 42321, 42322, 42326, 42329, 42332, 42341, 42357, 42363, 42364, 42365, 42366, 42367, 42370, 42371, 42374, 42375, 42377, 42380, 42382, 42386, 42391, 42398, 42403, 42405

TRAPPING (SAMPLING)
41612

TRAY TOWERS
41432, 41633, 41728

TREATED FABRICS
41649, 41681, 41686, 41865

TREES
41283, 41431, 41791, 41878, 41982, 42212, 42214, 42221, 42222, 42225, 42227, 42228, 42229, 42230, 42236, 42246, 42254, 42257, 42258, 42272

TRENDS
41199, 41201, 41208, 41215, 41220, 41222, 41225, 41258, 41259, 41260, 41280, 41306, 41323, 41388, 41393, 41408, 41610, 41850, 41875, 41880, 41888, 41894, 41899, 41938, 41940, 41973, 41996, 42107, 42144, 42271, 42306, 42321, 42377, 42378, 42394, 42395, 42399, 42401

TRUCKS
41227, 41228, 41237, 41264, 41269, 41281, 41366, 41420, 42391, 42398

TUBERCULOSIS
42097

TUMORS
42092, 42109, 42179, 42186, 42205

TUNNELS
41242, 41872, 41895, 42156

TURBIDIMETRY
41840, 41883, 41953, 42075, 42158

TURBULENCE (ATMOSPHERIC)
41430, 41724, 41916, 41917, 41932, 41937, 41945, 41947, 41952, 41975, 41976, 41991, 41993, 42001, 42003, 42021, 42086

U

ULTRASONICS
42089, 42202, 42203

ULTRAVIOLET RADIATION
41854, 41945, 42026, 42056, 42403

ULTRAVIOLET SPECTROMETRY
41710, 41712, 41719, 41755

UNITED KINGDOM
41195, 41215, 41239, 41240, 41258, 41276, 41281, 41283, 41284, 41295, 41315, 41324, 41345, 41346, 41394, 41401, 41436, 41439, 41440, 41481, 41486, 41493, 41500, 41506, 41521, 41522, 41523, 41546, 41554, 41572, 41590, 41606, 41611, 41632, 41691, 41696, 41708, 41761, 41775, 41789, 41798, 41819, 41842, 41883, 41900, 41919, 41939, 41958, 41960, 42014, 42017, 42081, 42150, 42163, 42172, 42177, 42179, 42188, 42243, 42248, 42263, 42279, 42280, 42287, 42288, 42303, 42374, 42399, 42401

UNITED STATES
41201, 41205, 41308, 41468, 41804, 41827, 41855, 41864, 41867, 41868, 41871, 41880, 41882, 41894, 41897, 41913, 41918, 41920, 41924, 41930, 41946, 41949, 41954, 41960, 41961, 41991, 42062, 42102, 42143, 42144, 42156, 42158, 42210, 42211, 42260, 42272, 42315, 42317, 42318, 42329, 42334, 42335, 42338, 42342, 42343, 42344, 42345, 42347, 42348, 42349, 42350, 42353, 42354, 42355, 42356, 42357, 42358, 42359, 42361, 42367, 42371, 42376, 42382, 42384, 42385, 42390, 42402, 42404

UNIVERSITIES
42336, 42340

UPPER ATMOSPHERE
41838, 41945, 42364, 42400

URBAN AREAS
41211, 41213, 41220, 41225, 41286, 41315, 41378, 41554, 41564, 41727, 41759, 41802, 41819, 41851, 41856, 41857, 41858, 41864, 41869, 41871, 41873, 41874, 41875, 41876, 41878, 41879, 41882, 41884, 41886, 41887, 41888, 41890, 41891, 41893, 41896, 41899, 41904, 41905, 41906, 41908, 41909, 41910, 41918, 41919, 41920, 41921, 41922, 41924, 41935, 41946, 41948, 41949, 41961, 41970, 41977, 41984, 41987, 41991, 42062, 42066, 42095, 42098, 42101, 42102, 42111, 42114, 42115, 42121, 42134, 42140, 42143, 42153, 42156, 42167, 42172, 42179, 42180, 42195, 42197, 42206, 42222, 42231, 42235, 42246, 42247, 42251, 42271, 42285, 42366, 42367, 42379, 42382, 42390, 42391, 42402, 42404

URINE
42099, 42120, 42126, 42151, 42168, 42173, 42177, 42185, 42191, 42192, 42194, 42198

USSR
41231, 41285, 41310, 41329, 41373, 41399, 41421, 41581, 41666, 41698, 41728, 41730, 41759, 41790, 41792, 41820, 41829, 41832, 41838, 41840, 41866, 41931, 41951, 41974, 42001, 42002, 42003, 42004, 42005, 42006, 42045, 42049, 42052, 42077, 42078, 42082, 42083, 42088, 42093, 42123, 42127, 42137, 42141, 42175, 42190

UTAH
41894

V

VALLEYS
42210, 42283

VANADIUM
41638, 42053

VANADIUM COMPOUNDS
41394, 41407, 41546, 41631, 41883, 42271

VAPOR RECOVERY SYSTEMS
41379, 41530, 41555, 41557, 41580, 41609, 42360

VAPORS
41221, 41236, 41311, 41357, 41365, 41379, 41404, 41426, 41453, 41551, 41555, 41589, 41615, 41617, 41637, 41698, 41712, 41763, 41766, 41783, 41805, 41820, 41885, 41915, 41925, 41951, 41966, 42011, 42017, 42035, 42039, 42042

VEGETABLES
42213, 42216, 42218, 42219, 42227, 42228, 42230, 42232, 42235, 42239, 42240, 42241, 42245, 42275

VENTILATION
41300, 41362, 41378, 41552, 41617, 41686, 42135

VENTILATION (PULMONARY)
42116, 42166

VENTURI SCRUBBERS
41270, 41308, 41328, 41363, 41416, 41426, 41450, 41501, 41517, 41567, 41647, 41650, 41651, 41663, 41664, 41680

VESSELS (MARINE)
41608, 42364

VIRUSES
41989, 42143

VISIBILITY
41284, 41775, 41803, 41848, 41871, 41915, 41956, 42013, 42385

VISIBLE RADIATION
41931

VOLATILITY
41244, 41557, 41752, 41925, 42008, 42088

VOLCANOES
41865, 41986, 42397

VOLTAGE
41757, 42047, 42051

W

WASHINGTON D C
41946, 42353, 42354, 42367

WASHOUT
41874, 41897, 41903, 41917, 41933, 41955, 41971, 41990, 41992, 42001, 42002, 42004, 42005, 42006, 42008, 42011

WASTE GAS CONTROL
41204, 41231, 41234, 41254, 41275, 41280, 41292, 41297, 41299, 41308, 41309, 41312, 41314, 41319, 41320, 41332, 41336, 41344, 41350, 41352, 41360, 41387, 41389, 41391, 41418, 41431, 41433, 41434, 41445, 41457, 41460, 41462, 41469, 41471, 41475, 41482, 41484, 41485, 41486, 41488, 41490, 41502, 41503, 41510, 41515, 41516, 41517, 41521, 41531, 41534, 41539, 41545, 41546, 41549, 41553, 41561, 41571, 41578, 41587, 41598, 41604, 41622, 41627, 41665, 41675, 41963, 42297, 42300, 42303, 42305, 42312, 42401

WASTE GASES
41193, 41198, 41204, 41206, 41208, 41213, 41215, 41216, 41221, 41222, 41231, 41234, 41238, 41239, 41251, 41252, 41253, 41254, 41263, 41270, 41271, 41275, 41277, 41278, 41279, 41280, 41286, 41289, 41291, 41292, 41293, 41297, 41299, 41302, 41307, 41308, 41310, 41312, 41319, 41320, 41326, 41328, 41332, 41336, 41340, 41341, 41345, 41350, 41351, 41352, 41354, 41358, 41359, 41364, 41370, 41371, 41381, 41382, 41383, 41384, 41387, 41389, 41391, 41395, 41399, 41401, 41407, 41411, 41413, 41416, 41418, 41423, 41428, 41432, 41433, 41437, 41444, 41445, 41450, 41452, 41453, 41454, 41457, 41460, 41462, 41469, 41475, 41476, 41479, 41481, 41482, 41484, 41485, 41488, 41489, 41490, 41491, 41493, 41495, 41496, 41499, 41501, 41502, 41503, 41505, 41508, 41510, 41513, 41514, 41515, 41516, 41517, 41519, 41520, 41521, 41523, 41524, 41532, 41534, 41539, 41540, 41545, 41546, 41547, 41549, 41553, 41558, 41559, 41561, 41563, 41567, 41570, 41571, 41572, 41574, 41578, 41584, 41585, 41587, 41588, 41592, 41594, 41600, 41604, 41605, 41613, 41615, 41619, 41620, 41622, 41623, 41624, 41625, 41626, 41627, 41635, 41638, 41644, 41649, 41651, 41653, 41656, 41663, 41664, 41668, 41670, 41672, 41673, 41674, 41675, 41680, 41685, 41688, 41690, 41693, 41701, 41712, 41719, 41720, 41721, 41739, 41742, 41743, 41751, 41755, 41763, 41766, 41771, 41778, 41781, 41784, 41808, 41809, 41815, 41816, 41839, 41845, 41866, 41878, 41898, 41909, 41914, 41932, 41955, 41989, 41990, 42073, 42096, 42278, 42279, 42281, 42297, 42303, 42305, 42312, 42313, 42328, 42332, 42350, 42354, 42362, 42374, 42380, 42391, 42393, 42398, 42401

WATER
41197, 41239, 41465, 41570, 41579, 41618, 41629, 41645, 41673, 41698, 41704, 41763, 41845, 41883, 41915, 41947, 41951, 41966, 42011, 42035, 42039, 42041, 42042, 42044, 42057, 42088, 42217

WATER BODIES
41235, 41239, 41243, 41277, 41278, 41326, 41352, 41373, 41447, 41455, 41469, 41597, 41605, 41898, 41938, 42256, 42402

WATER POLLUTION
41235, 41239, 41243, 41277, 41278, 41326, 41352, 41373, 41447, 41455, 41469, 41597, 41605, 41898, 41938, 42256, 42402

WEATHER FORECASTING
41977

WEATHER MODIFICATION
41199, 41276, 41564, 41918, 41922, 41953, 41960, 41966, 41971, 41973, 41985, 41986, 41987, 41988, 41990, 42010

WEST VIRGINIA
41867, 42355

WET CYCLONES
41231, 41390

WETTING
41295, 41321, 41349, 41506, 41645, 42292

WHEAT
42277

WIND TUNNELS
41991

WINDS
41276, 41285, 41564, 41704, 41739, 41782, 41799, 41851, 41872, 41875, 41881, 41890, 41893, 41901, 41903, 41905, 41907, 41909, 41910, 41914, 41915, 41916, 41917, 41918, 41921, 41922, 41925, 41927, 41930, 41932, 41934, 41935, 41936, 41937, 41950, 41952, 41953, 41954, 41956, 41957, 41962, 41964, 41965, 41970, 41976, 41977, 41978, 41982, 41983, 41984, 41989, 41994, 41995, 41999, 42000, 42003, 42007, 42013, 42102, 42236, 42262, 42362, 42364, 42393, 42404

WISCONSIN
41804, 42315

WOOD (MATERIAL)
41431, 41455, 41624, 42181, 42318

X

X-RAYS
41273, 41433, 41703, 41713, 41714, 41745, 41776, 41807, 41855, 41971, 42034, 42154, 42286

Y

YOKKAICHI
41869, 41950

YOKOHAMA
41888

Z

ZINC
41434, 41654, 42192, 42282

ZINC COMPOUNDS
41243, 41756, 41855, 41891, 41898, 41942, 42096, 42118, 42163, 42165, 42198, 42258, 42260, 42264

AUTHOR INDEX

A

ABE K *41289
ABELITIS A *41279
ABELS T *41290
ABRAHAM R P 41789
ABRIGEON E 42100
ACRES G J K *41481
ADAMS C E *41603
ADAMS R C *42367
ADAMS T C 41196
ADEDIPE N O *42259
ADLER G M *42368
AGNIHOTRI U S 42290
AGOPIAN K G 42066
AHN C H 42022
AKATSUKA S *41950
AKIYAMA S *41690
ALARY J 41701
ALBRECHT J *41681
ALENGRIN F 41701
ALETA C R *41604
ALIVERDIYEVA S S *41285
ALTES J A 42102
ALTSHULLER A P *41774
ALTWICKER E R 41220
AMAR YAN A P 41677
AMARAL L 42131
ANAVI T 41875
ANDEL A 42166
ANDERSON C E *41605
ANDERSON D M 41688
ANDERSON R J JR *42307
ANDERSON W C *42242
ANDERSON W M 41518
ANDO J *41482
ANDO K 42164
ANDO T 41793
ANDREWS L 42048
ANDREYEV B G *41832
ANDRIESE P C 42276
ANDRZEJEWSKI M *41647
ANKO T *42328
ANTAL A 42096
AOMURA K 42046
APSIMON H 41958
ARAKI K *41291
ARASHI N 41519
ARENDT H *41483
ARIYOSHI K 42068
ARMSTRONG B S *41691
ARNOLD A 41941
ARONOW W S *42155
ASAI M 42142
ASAKUNO K 41736, *41848, 41854, 41856, 42026
ASHLEY K *41606
ASHTON G C 42245
ASPLING G 41917
ASTRUP P *41607
ATKINS R S *41484
AVANZI M *41648
AVERKIEV M S *41951
AVRAMENKO A S 42004
AVY A P *42080
AXEBORG T V Y *41292
AYLOR J T 41783
AYRES S M *42156
AZUMA K *41293, 41383

B

BABCOCK A W 41303
BABICH H *42157
BABINSKI S 41659
BACH W *42158
BACZYNSKI T *42059
BADGLEY F I 41969
BAILLEUL M R *41280
BAKANOV S P 42082
BAKER B B JR *41692
BAKER J A *41294
BAKULIN V N *42001
BALDECK C M *41693
BALTRUSCH M *41914
BAN Y *41849, *41850
BANSAL R C 41559
BAPSERES B 41280
BARBER G *41295
BARENBERG E J *41296
BARETTA E D 42153
BARLEY R C 41216
BARON S *42293
BARRETT D *41297
BARRETT R E 42259
BARRINGTON A E 41717
BARTELS H *41915
BATEMAN D A 41775
BATES C E *41193
BAUM F 41720
BAUM H E *41298
BAVLEY H *42135
BAZHENOV V A 41730
BEARD M E *41694
BEAUCHAMP J J 42324
BEAVON D K *41299, *41485
BECK E G *42136
BEECKMANS J M 42029
BEER J M *41486
BEESE J G 41691
BEHAR J V 41924
BEHRENS M 41488
BEKE G 41744
BELANGER G *41695
BELL F J *41696
BELMONTE R B 42033
BELOHRADSKY J J *41608
BELOT Y *41697
BEN KOVSKIY V G *41698
BENEDETTI MICHELANGELI G *41916
BENNETT B I 41702
BENNICK J E 42070
BENTLEY H R *42279
BERGE H *42369
BERGERT K H *41699
BERGGREN B 41282, 41938
BERNERT J *41300
BERNHEIM J 42100
BERNSTEIN R J *41301
BERUBE J L 42211
BETTONEY W E 41492
BETZ V 41699
BEVERIDGE T R *41609
BEZENECH C 42207
BHARDWAJ S S 41558, 41559
BIENSTOCK D 41385
BIERSDORF G T 42264
BIETRY J *41302
BIGNON J 42152
BILLARD F *41649
BILLINGS C E 41688
BINFK B *41833
BINGHAM E 42171
BIRD B M 41346
BIRDSEYE H E 41705
BIRKLE M *41700
BLACK F M *41770
BLACK J W C *42387
BLANCHET J *41952
BLOCKER W V *41303
BLUMBERG P N *41487, 41536
BOCCIO J L *41236
BODLE W W *41304
BOERTITZ S *42209
BOETTNER E A 41897
BOHLE J B 41626
BOJOVIC V 42198
BOLIN B *41917
BOLL R H *41650
BOLTER E 41243, *42260
BONDAREV G K 41329
BONNAUD G 42152
BONSANG B 41852
BOODMAN N S 41427
BOUFFARD R A *41305
BOURBON P *41701
BOURELLY T *41286, *41679, *41839, *41901, *41902, *41903, *41907, *41908, *41909, *41910
BOWSER R J *42014
BOYER A E 41984
BRACKETT C E *41306
BRADBURN G 41924
BRADSHAW A D *42243
BRAETSCH P *41488
BRAGG G M *42015
BRAIL R K *41259
BRATZLER K *41489, *41678
BREINING H 42118
BRENNDOERFER M 41327
BRENNER G M *42159
BREWER R F *42210
BRIDGSTOCK G *41490
BRINK R H *41307
BRION J 41649
BROCKE W *41308
BROGAN J J *41610
BROICH F *41309
BROMBERG S M *41702
BROMLEY A F 42287, 42288
BROWER D L 42264
BROWN C W 42063
BROWN D L *41892
BROWN N E 41855
BROWNE L W B *42016
BRUIN A D *42185

BRYAN R J 42143
BRYSON R A *41953
BUCHHEIM R *41194
BUCHHOLZ R G 41668
BUCKLE E R *42017
BUDNIK N M *41310
BUECHNER M 42099
BUKOVSKIY M I 41728
BULKIN Y P 41581
BURBIDGE B W *41611
BURGAN J G 42279
BURKHANOV A I *42137
BURRELL G J *41775
BURSTEIN N *41311
BURTON E S 42339
BURTSEV I I *42002
BURTSEVA L V 42002
BUSSE M *41491
BUSSMANN B *41312
BUSSO R *41271
BUSTERUD J A *42370
BUTHERUS D 42260

C

CAHILL T A *41954
CAMARASA M *41313
CAMERON J W *42244
CAMERON L C *41314
CAMP D C *41703
CAMPBELL K *41315
CANTWELL E N *41492, *41612
CAPP J P *41316, 41410
CARAGAY A B *42018
CARLSON D P 41692
CARLSON H C *41317
CARNEY A W *42245
CARROLL J M *42371
CARTER J A 41764
CASARETT L J *42160
CASCARINI DE TORRE L E *41318
CASHINS R F 42135
CASTRO R F D *41672
CATO G 41266
CAUWENBERGHE J V *41704
CECLIONI V A *42092
CERMAK J E 41991
CHAKRIN L W 42124
CHALLIS E J *41195
CHAMPION P *42186
CHANDER Y I 41407
CHANDLER G *41493
CHARPENET L *41494
CHAUDHRY F H *41991
CHEN R 42260
CHENG L *42019
CHEREPOV Y M *42093
CHIANG J J 41762
CHIMIKLIS P 42217
CHIU G 42084
CHOW C K *42161
CHOW T J *41874
CHROSCIEL S 41657
CHRUSCIEL R *41319
CHWALIBOG H *41613
CIOSEK A *41805
CLACK J 41632
CLARK W E 41871
CLARKE J F *41918
CLEMENS D H *41495
CLEMENT J L *41651
CLINE J E 41717
COLACINO M *41851
COLEMAN R D 41688
COLLISON H A 42117
CONGEDUTI F 41916
CONNORS E JR 41688
CONSER R E *41496
CONSTANTINESCU P *41320
COOK H A *41614
COOPER J A 41703, *41776
COOPER J C *41705
COOPER R M 42387
COSTELLO G 42158
COUGHLIN R W 41618, *41673
COUNTESS R J *41706
COUSIN M 41649
COWLING D W 42263
COX R A *41919
CRAKER L E *42211
CRAWFORD R W *41777
CREED E R 42248
CRIST H L 41693
CRISTOL P *42207
CROCKER T D 42307, *42308, *42381
CROCKER T T *42138
CROKE E J *42382
CROKE K G 42382
CROOK J O *41321
CROSS C E *42094
CROSS F L JR *41497
CROW R H 41499
CROWE C T 41577
CROWLEY J H *41778
CULL N L 41574
CUNNINGHAM P T 42057
CUONG N B *41852
CWYNAR B 42291

D

DAESSLER H G *42261
DAITO S 42027, 42028
DAKE J D 41746
DANA M T *41955
DANJO A 41218, *41322
DARGENE N P 42006
DARLEY E F 41246
DARLING S M *41323
DATE N *42212, 42231, 42235, 42239, 42240
DAUTZENBERG F M *41498
DAVIDS P 41308
DAVIES C N *42081
DAVIES G F *41499
DAVIS G L 42102, 42130
DAVIS M L 41563
DAWSON J K *41324
DE GROOT M 41758
DE PENA R G 42030
DEBACKERE M 42223
DECKER C E *41779, 41867
DEFALCO P JR *42329
DEKNUDT G 42223
DEL BORGHI M 41334
DELARNE E 41649
DEMETER J 41385
DEMOISE C 42143
DEMORE W B 42065
DENCE G R *41500
DENGLER F 41713
DENNIS R *41688
DERBIN G M *41652
DERYAGUIN B V *42082
DESCHWANDEN P V *41992
DETRIE J P *42372
DIANIS W *42020
DICKINSON L 42158
DIETRICH H *41325
DIETRICH K R *41326
DILLOWAY A J *41260
DIRKS R A *41920
DITZLER R C 41311
DMITRIJEW M T *42000
DODD H C 42153
DOERGES A 41489, 41678
DOHNE E *41327
DOI K 41293
DOLE S H 42376
DOMALSKI W 41488
DONAGI A E *41875, *42373
DONNELLY R J 41705
DONOHOO K K 42153
DORFMAN N S *42300
DOROSHEVSKIY V V 41329
DOROUGH H W *42139
DORR H H *41501
DORR K H *41328, 41502
DOYLE B W *41780
DRESCHEL H *41502
DRINKER P 41688
DRIVAS P J 41711
DUCKETT J G 42248
DUGGER W M JR 42275
DUNCAN J R *42280
DUNSON J B JR *41834
DURANDET J *41503
DURIC D *42198
DUVACHAT R 41952
DWORETZKY L H 41893
DWYER F G *41504
DYKTOR H G *41913
DZYADZIO A M *41329

E

EARL C B *41505
EASLEY W C *41821
ECKERT J S *41615
EDELMAN R B 41236
EHATO T *42140
EICHMEIER J *41806
EISHOJI Y *41330
ELDER J C 41333
ELFERT R J JR *41331
ELLIOTT T C *41332
ELLSAESSER H W *42327
ELSHOUT A J 41206
ENDERS K L *41853
ENDO Y *41956
ENGELS U *41616
ENGVALL A G 41282
EPHRAIM M JR *41261
EPSTEIN S 42392
ERICKSON N E 42034
ESCLASSAN J F 41701
ESTEP E M 41196
ETTINGER H J *41333, *41707
EVANS L S *42213
EVANS M J 42125
EVANS R G 42156
EVNEVICH T V 41951
EZAKI A 41784
EZRA D J *41506

F

FABER G E *41507
FAIRCHILD C I 41707
FARRAUTO R J 42067
FARRINGTON F 41401
FASSETT D W 42392
FEDER W A 42249
FEENEY P J 41954
FEIGE N G *42281
FELDMAN C 41764
FELDSTEIN M *42330
FELTON J S *42162

FERNANDEZ G E 41318
FERRAIOLO G *41334
FERRER J M 42181
FERRY G 42210
FIALKOV Y G 41666
FIELD D E 41216
FIELD R *41262
FINGER G *41335
FIRTH J G *41708
FIRTH J N M *42163
FISCHER H *41336
FISER V *41682
FISHER E R *42073
FLECK R N 41299
FLEISCHER M *42392
FLEMING D K *41508
FLEMING R D *41237
FLETCHER J R 41405
FLOCH H F 42181
FLORANCE E T *41807
FLORY A 42100
FLOWER F B 41497
FLYNN C S *41674
FOLEY H M *41979
FONTANGES R 42100
FORNEY L J *42021
FORREST J *41781
FORREST L 41535
FORSTEN I *41309
FOURCADE J 42307
FOURNON JOLY S 42100
FRANK E R 41844
FRANKSTEIN S I *42141
FREDERICK P 42217
FREDRICKSON P B 42211
FREEMAN A E 42143
FREEMAN G 42125
FRENCH J G *42095
FRENCH T R 41237
FRIEDLAND A 42373
FRIEDMAN B M 41216
FRIEDMAN H A *41782
FRIEND J P *41980
FRIMESCU M *41957
FRKAL J 41566
FUCHS N A *41840, *42083
FUERST R G *41709
FUHRMANN H *41710
FUJITA N *42214
FUKAMI A 42027, 42028
FUKASE O 42113
FUKUDA H 41630, 42235
FUKUOKA S 41857, *41921, *41922, 41935, 41936, 41937, 42332
FUKUSHIMA H 41213, 41742
FUMAROLA G 41334
FUNASHIMA M 41848, *41854, 41856, 42026
FUNKHOUSER J T *41822
FURKERT H *41510
FURUUCHI I *42142

G

GADEFELT B G *41511
GAEDE P J 41621
GAJDOS A *42187
GAJDOS TOROK M 42187
GALANIN I I 41677
GALLAER C A *41337
GAMBELL J W 41565
GANT P L *41783
GANTNER G E 42102
GARDENIER H E *41653
GARLAND J A 41939
GARNETT A *42399
GARTNER J J *41512
GAY Y 42373
GAURI K L *42286
GAVRILYUK M V 41231
GAYDA J P 41585
GEGA J 41665
GEISS F 41758
GENSLAK S L 41376
GENTRY J W *42022
GEORGESCU L 41320
GEORGII H W *41923
GERMAIN D 42100
GERRARD J S 41521
GEYER G 42165
GHAHREMANI F G 41535
GHASEMI A 42151
GHIAMI A 42151
GIAUQUE R D *41855
GIBSON R O *41617
GILBERT T *42393
GILES W H *41893
GILLMORE D W 41316
GIOVANNI D V 41241
GISIGER L *42277
GLODAN L *42096
GLORIA H R *41924
GLOWIAK B *41654, *42291
GODA L Y 41855
GODDARD A J H *41958
GOETZ A *42008
GOLDSTEIN B *42097
GOLDSTON L N 41913
GOLOVACHEVSKIY Y A 41666
GONI J 42152
GONZALES M 41333
GOODSELL D *41338
GORANSON S K 41702
GORDON R J *42143
GORDUS A *42144
GORIN N H *41808
GOTO K 41727
GOTTLER H *41513
GOTTSCHLICH C F *41238
GOULDIN F C 41604
GRAFF S A 42153
GRAHAM R A *42023
GRANCHER P *41514
GRANTHAM J B *41196
GRANTHAM L F 41596
GRAOVAC LEPOSAVIC L 42198
GRAY J T 41250
GREEGOR R 41747
GREEN H S *41959
GREEN M 42384
GRIFFITH G A *41711
GRIMM H 41328, 41501, 41502
GROBMAN J *41197
GROENENDALL W *41515
GROMOTKA H *41198
GROSICK H A 41529
GROVER R *41925
GROVER THOMAS *41516
GRUENDER H D *42215
GUCKER F T *42084
GUIDA K *41339
GUINES S H *42098
GURTLER H C 41325
GUSHEE D E *42331
GUTERMAN I G *42003
GUYOT G L 41280
GVIRTMAN B *41712

H

HAASE R 42053
HAEFELE W *41199
HAHN K *41200
HAIS K 42278
HAKE C L 42153
HALBHUBER K J 42165
HALES J M *41926, 41955
HALLENRUD S J H 41786
HAMADA T 41330
HAMANO T 41230
HAMBERG O 41535
HAMMER H *41340
HAMMER M 42376
HAMMOND P 42392
HAMPL V *41841
HAMPP R *42216
HANEI T 42038
HANNA G F *42074
HANSEN M *41713
HAPPEL J *41675, 42069
HARADA A *42400
HARGER J R E *42262
HARLOW F H 41961
HARRIS C N 42155
HART R H *42195
HARTMAN F W JR 41803
HARTMAN M *41618
HARTMANN W D *41201
HARTMEN M 41673
HARVEY G R *41927
HASEBE T 41582
HASEGAWA M 42142
HASHIMOTO K *42164
HASUO Y 41630
HATTORI M *42145
HAUFFE K *42060
HAUSBERG G *41517, *41619, *41620
HAWKINS A E *41239
HAYAKAWA M 41879
HAYASHI K *41341
HAYASHI S 41784
HAYES J V 41972, 41982, 41983
HAYNES C D 41590
HAZZARD N D *41518
HEATH R L *42217
HECHT T A *42061
HEDLEY A B 41486
HEDRICH H *41621
HEEMSTRA R J *42076
HEGEMANN K R 41619, 41620
HEICKLEN J 42030
HEIDERMANNS G *41714
HEITMANN A *41342
HELMER R *41343
HEMMERLING H 41524
HEMPHILL D 42260
HENDERSON J M *41344
HERBERT I C *41345
HERLAN A *41202
HERLANDS M S 42367
HERMAN B M 41836
HERMANCE C E 42015
HERTZ M B *41894
HESS W T 41317
HETHERINGTON A F *41240
HEUSDEN S V *41715
HICKISH D E *41281
HIDY G M *42062
HIGAKI K *41622
HIGH L E 41770
HIKIMA M 42228, 42229
HILT M G *41241
HIMI Y *41716
HINCHMAN H B 41595
HIND M A *41346
HINTON M 41535
HIRAFUNE K *41904
HIRAO M *41623
HIROBE H 41869

HIRONO T 41736, 41848, 41854, *41856, 42026
HIROYASU H *41203, 41448
HISHINUMA Y *41519
HISLOP J S *42188
HOBBS C H 42070
HOBBS J R *41717
HODGES G H *42270
HODGSON J W *41347
HODKINSON J R *41842
HOFFMAN R A 41612
HOFFMANN D 42193
HOFMANN F *42099
HOFMANN K *41809
HOLDGATE M W *41960
HOLLAENDER W *41718
HOLLNAGEL M 41335
HOLMES R E 41958
HOMOLYA J B *41719
HONDA S 41291
HONDA T 41793
HOPKINS A G *42063
HOPPE K *41348
HORAK J 42013
HORI M *41349
HORI S 41482
HORINO S *41204
HORIOKA M *41350
HORLANDER L A JR *41520
HORVATH H *42024
HOSHIDA I *42025
HOTCHKISS R S *41961
HOUGHTON R *41521
HOUSE W T 41603
HOUSTON P S *41522
HOWE R H L *41263
HRYNIEWICZ R *41823
HUBER D A 41596
HUBER H *42312
HUEBNER R J 42143
HUEBSCHER J *42165
HUENLICH H W *41351
HUGHES R *41523
HULEWICZ Z *41655
HUNNEYBALL P D 41819
HUNZIKER R *41720
HUTCHINSON T C *42271
HYLAND E J *42294

I

IACONA C J 41668
IBRAGIMOV F K 42052
ICHIHARA A *41721
IDEMURA H *41352
IIDA Y 41229, *41353, 41355, 41449, *41722
IIJIMA M *41354
IIJIMA T *42218, *42219, *42220, 42228, 42231, 42235
IJUIN Y 41757
IKEBE Y *41810, *41876
IKURA S 41203, 41448
IMASE W *41624, 41635
IMPARATO B 42155
INAO N *41784
INGEBO R D 41197, 41551
INOUE K 41229, 41230, *41355, *41356, 41449, 41722
INOUE S 41443
IOFFE L Y 41310
IOKA S *41357
IRELAND F E *42374
ISBELL M W 42155
ISHIDA K 41876
ISHIGURO I *41242, *41962
ISHIGURO T 41213, 41742, *42313
ISHII U 41922
ISHIKAWA S *41928
ISHIKITA R 42068
ISHINO T *41877
ISOARD P *42100
ITAKURA A *41878
ITO M *41857, 41922, 41936
ITO N 41848, 41854, 41856, 41869, 42026
ITO R 41527
ITO T *41358
IURA T 41535
IVANOVA E S 42141
IVERACH D *41963
IWAI Y 42142
IWANAGA M *41723
IWANAMI M 42228, 42229, 42235
IWASAKI Y 41213, 41742
IZUMI R 41353
IZUMIKAWA A 41741, 41848, 41854, 41856, 41862, *42026

J

JACOBS M H 41819
JAMES N J 41523
JASKULLA N 41421, 41422
JAURAND M C 42152
JAVORSKY B *41359
JENNETT J C *41243
JENSEN D R 41941
JERNELOV A 42256
JIRAK Z *42166
JOHNSEN I *42246
JOHNSON C J 41537
JOHNSON K E *42287, *42288
JOHNSON S A 42057
JOHNSON T E *41360
JOHNSTON A A 41250
JOHNSTON D R 41867
JOHNSTON H S 42023
JOKSCH H O *41361
JOLLEY L J *42401
JONES L H P *42263
JONES P W 41882
JONES T A 41708
JORDAN W V *41524
JORDEN R M 41244, *41272, *41273
JOSEPH D W 41882
JOSEPH J 41794
JOST D *41929, *41993
JOUTSEN E O *41656
JUDA J *41657
JUETTEMANN H *41362
JUGEL W 41538

K

KAAKINEN J W *41244
KABAYAMA H *42101
KADOWAKI S *41858
KAHN A *42102, 42130
KAHN E 42162
KAISCHEW R *42085
KALB G W 41693
KALBFLEISCH J H 42153
KALMARU A M 41581
KALPASANOV J *41964
KAMINO K *41363
KAMIYA A *41785
KAN K 42228
KANAE Y 42115
KANAMARU K *42027, *42028
KANEDA K 41865
KANEDA M 41928
KANEOKA C *41724
KARLOWITZ B *41525
KASAI A *42295
KASINA S *41994, *41995
KASPRZYCKI A *41824
KATES F F 41507
KATO T *41879
KATO Y 41633
KATOU T *41811
KAUF H *42009
KAUP F *41274
KAWADO K *41725
KAWADO T 41962
KAWAMOTO A 42214
KAWASAKI H *41364
KAWASAKI I 42253
KAWASE B *41365
KEEN I M 41611
KELLER J 41348
KELLER T *42221
KEMPEN H W J *41366
KENDALL D A 42018
KENNEDY D C *41526
KENT R E *41625
KESSEL H 41402
KHAYLOV V M 42045
KHAZAN R M 41310
KHRAPAL G V 41399
KIDO T *41965
KIESE M *42208
KIESE O *41966
KILBURN K H *42103
KILLICK D E 41775
KIMURA H 41727
KINARD J T *41726
KINOSIAN J R *41880
KIRCHGESSNER M *42146
KIRKPATRICK L W *41205
KIRSCH H *41859
KIRSCHBAUM U 42236
KISNER J W 41208
KITAGAWA T *41930
KITROSSKIJ N A 42000
KLEE R 42236
KLEIN J H 41781
KLEIN M C *42104
KLEINHENZ A 41524
KLIMA J 41270
KNAPP K T *41812
KNELSON J H *42105
KNETTIG P *42029
KNIGHT K L 41281
KNIGHT R G 41433
KNIZIA K *41367
KNUTSON E O *41967, *41968
KOBAYASHI Y 41869, 42058
KOBOTSEV N I 41677
KOBYLINSKI T P *41368
KOCH H *41369
KODAMA T *42247
KOEHLER G R 41522
KOGURE Y 42276
KOIKAWA S 41443
KOIKE N 41227, 41228
KOIVIKKO A *42106
KOJIMA I 41365
KOJIMA S *41727
KOJIMA T *41527
KOKOKAWA M 41550
KOLA R 41328, 41501
KOLESNIK M I *41728
KOLGANOV V A 41685
KOLOSCH E 41566
KOMAKINE C *41528
KOMATSU S *41370
KOMEIJI T *42222, 42231, 42235
KOMUKAI T 41582
KOMURO K *41371

KONDO M 41582, *41729
KONDRAT EV K Y *41931
KONRAD T G 41941
KOOIJ J V D *41206
KOSE M 41293
KOSMIDER S *42147
KOTAKA S 42276
KOTOK D 42104
KOUKOL J *42275
KOUWENHOVEN H W 41498
KOVACIC J E *41529
KOZIK C 41638
KOZUKI M 42036
KOZYREV B N *41730
KRACKE W 41828
KRAMER W E *41530
KRAUS B J 41313
KRAUSE U *41275
KRELL L 41348
KRENKE G *41731
KRILL H *41531
KRIMMEL J A *41813
KRONBERG P *41732
KRUEGER A P *42276
KRUGLOV B I 41581
KRZYSZTOFIK B *41825
KUBIE G *41843
KUBO U *41733
KUDO Y 41849
KUFNER G 42173
KUKIN I *41532
KUMMER J T *41372
KUMMLER R H 42073
KUNIN R 41495
KURIHARA S 42239
KURITA K 41622
KURIYAMA M *41881
KURODA D *41734
KUROSAKA Y 41753
KUROSAWA T 41580
KUROSE M 41857, 41935, 41936
KURTSCHATOWA G 41964
KUSHNIR J M 42035
KUSLER D J *41533
KUZNETSOV N I 41581
KUZUOKA T *41373
KYODA M 41921, 41922, *42332

L

LAEMMEL P *41207
LAGERWERFF J V *42264
LAMB D V *41969
LAMB D W *41374
LAMBERT G 41852
LAMME S E V 41786
LAMONTAGNE R A 41944
LANDAHL H D *42148
LANDRETH R *42030
LANDRUM L H *41534
LANGE H B JR *41208
LAPEDES D E *41535
LAPOINTE A J *41658
LAUB H *42282
LAVAGNINI A 41851
LAVE L B *42149
LAVENNE F *42167
LAVERNE A *42196
LAVERNE A A *42197
LAVOIE G A *41536
LAWTHER P J *42150
LAZO L R *41626
LEAHEY D M *41932
LEAS L E *41537
LEAS R E 41537
LECH J F *41735
LEE D H K *42107
LEE N *42383
LEE R E 41893
LEE R L S *41970
LEES D R *42248
LEFEMINE G 42109
LEFFLER L 41266
LEFRANCOIS P A 41360
LEHRER I H *41375
LEINBERGER H 42173
LENCIONI D E *42031
LENZ K *42010
LEON A 42069
LEONARD A *42223
LEONARD J W 41435
LEONOV L F 42088
LESTER J E 42020
LEVINS P L 42018
LEVY A 41882, *42064
LEWIS N *42384
LI C T 41591
LICHT D 42156
LIEBERMAN A *41835
LIEBERSTEIN H M *42301
LIGHT M E 42070
LIN C L *42065
LINDAHL B O *41786
LINDENHOFEN H E JR *41814
LINDVALL T *41787
LIPP E 41209
LISICKA I *41895
LIU B Y H 41458, 41459
LIU C Y *42066
LIUKONEN L R *41815
LIVKE T N 41231
LOCKERETZ W *41933
LOCKHART B D *41376
LOCKYER D R 42263
LODGE J P JR *41844, *41860
LOEBLICH H J *42333
LOFFLER F *42032
LORAINE J A *42394
LORD H C *41788
LOTZE J *41538
LOVE G J *42108
LOVELAND W D 41868
LOVEWELL C E S *41377
LOWDER J E 42031
LOWRANCE 41387
LUCKAT S *42283
LUECKE R *41209
LUNDSTROM H *42274
LYON W S 41764
LYSIKOV V M 42052

M

MA Y H *42033
MACHADO P A 41860
MACHALA O *41683
MACHOL S D 41976
MACKEY G R 41803
MACLEOD J *41627
MADEY T E *42034
MAEDA M 41383
MAEKAWA K *41378
MAESHIBA S *41379
MAGUIRE B A *41789
MAHAJAN O P 41558
MAHLMAN J D *41981
MAIER K 41219
MAJ U *41896
MAKHONKO E P *42004
MAKHONKO K P 42004
MAKINO K 41729
MALAKHOV V A *41790
MALCOLM D *42189
MALTONI C *42109
MALYATOVA G F 42052
MAMANE J 41875
MANDELS M *41210
MANES A 42373
MANESS D D 41574
MANGIAROTTY R A *41276
MANNING W J *42249
MANOJLOVIC M 42136
MAPPES R *42168
MARCINKOWSKI S *41659
MARGESON J H 41694, 41709
MARGRAF A *41539
MARINI T 41697
MARKANT H P 41651
MARMAI U 41491
MARPLE V A 41871
MARRIOTT R 42073
MARTENS D C *42224
MARTIN H Z *41540
MARTINEZ Y M 41813
MARUMO Y 41965
MARUOKA H *41541, *41542
MASEK V *41826, 41863
MASON H J JR 41782
MASTER K M *42110
MASUDA N *41380
MASUMOTO Y 42352
MATSUBARA F 41630
MATSUI M *41211
MATSUO I 41381
MATSUO M *41381, *41382
MATSUOKA H *41383
MATSUSHIMA J *42225, *42226
MATSUSHITA M *41543
MAUDERLY J L *42169
MAYEVSKAYA Y S 41677
MAYO F T *42388
MCCAIN J D *41384
MCCALLISTER M A *41934
MCCANN C *41385
MCCONNAUGHEY P W 41818
MCCRINK E J *41628
MCDOWELL D W JR 41392
MCELROY J L 41918
MCGLENNON J A *42334
MCGLENNON J A S *42335
MCILROY R A 41651
MCINNES A C 41818
MCKEOWN K J 41572
MCLAREN E *42035
MCMICHAEL D F *42296
MCMULLEN G L *41386
MCNESBY J R *41816
MEHTA K C *41676
MELIERE *41387
MELLOR A M *41245
MELTZER J 41535
MENSER H A JR 42270
MERRILL E W *41629
MESZAROS E *41911
MICHELS H T *42284
MICHISHITA H 42142
MIDDLETON J T *41246
MIELENZ R C *41388
MIKHAYLOV Y P 41310
MIKUCKI W J 41563
MILHAUD P 42100
MILIC S 42198
MILLECAN A A 42272
MILLER D F *41882
MILLER E P *41660
MILLER P R *42272
MILLER W E *41389
MILLY G H *42201
MINESCU F *41390

MINETTE A 42167
MINIGISHI A *41736
MINNICK J L *41391
MIQUE M 41952
MITCHELL E 41530
MITSUI K *42111
MIYABE H *41630
MIYAKE Y *42265, *42266, *42267, 42268
MIYAMOTO M 41849, 41850
MIYAMOTO S 41413
MIZOGUCHI K 42247
MIZUTANI Y *42036
MOCKRIDGE P C *41392
MOELLER D W *42336
MOFFITT J V 41250
MOGENSEN F K *41737
MOHANRAO C J *41545
MOHNEN V A 42035
MONTFOORT A G *41393
MOORE D O 41360
MOORMAN E F *41661
MORGAN W L *42067
MORIGUCHI M 41922, *41935
MORIKAWA M 41293
MORISHIMA H 41736
MORITA T 41784
MORITA Y 41928
MORIYA M *41738
MOROIANU I 41957
MOROOKA M 42068
MORRIS R B 41216
MORRISON D W *41264
MORRISON R E 41303
MORTON W E 41303
MOSER E *41817
MOSES C A 41250
MOSS G *41394
MOTES B G 41783
MOTOHASHI S 42212, 42218, 42219, 42239, 42240
MOYES A J *41546
MOYSEENKO H *42375
MUDD J B *42250, 42252
MUELLER W J 41923
MUHLRAD W *41547
MUHR W 42032
MUKHLENOV I P 41310
MURAKAMI M 41850
MURAKAMI T *41548, *41861
MURAMATSU F 41716
MURAOKA M 41857, 41935
MURASE A *41739
MURATOVA Y V 41728
MURTHA P A *41791
MUSICK J K *42037
MUTAFTSCHIEW B 42085

N

NABER J E 41498
NAGAHAMA F *42112
NAGANO Y 42142
NAKAGAWA S 42253
NAKAI Y *41395
NAKAJIMA T *42113
NAKAMITSU S *42337
NAKAMORI Y 41784
NAKAMURA A 42352
NAKANISHI H *42302
NAKANISHI S 41733
NAKANO K *41740, *41741, *41862, 42026, 42058
NAKANO M *41396
NAKANO N 41784
NAKAURA H 41857, 41922, *41936
NAKAYAMA K *41397
NAKAYAMA S 41383
NAKAZIMA T 42051
NAMIE K 42253
NANDA J N 42290
NARUSE Y 41879
NASEK J *42278
NAVEH M 42373
NEBASH S P 41818
NEBEL C *41398
NEISER J *41863
NEKRICH Y M *41399
NELSON W L *41631
NERIHAYA N 41460
NESTER K *42007
NEWHALL H K *41400
NEWMAN L 41781
NEWTON P E 42153
NICKLIN T *41401, *41632
NIELSEN H *41212
NIFONG G D *41897
NIGOL O *41549
NIKIFOROVA N K *41792
NIKITINA A P 41666
NISBET I C T *42170, 42392
NISHI R 41218, 41322
NISHIDA K *41793
NISHIHARA T 41729
NISHIMURA M 42025
NISHIWAKI A *41633
NISHIYAMA K 42257
NISHIZAWA K 42276
NITZSCHE H G *41402
NODA S 41443
NOHIRA H *41550
NOONKESTER V R 41941
NORCO J E 42382
NORD P J *42171
NORDBERG G F *42114
NORGREN C T *41551
NOTO T 41582
NOUCHI I 42222, *42227, *42228, *42229, *42230, 42231, 42233, 42234, 42235
NOWAK Z *41403
NUMATA M *42251
NYBERG P U J 41656
NYSTROM J 41210

O

O BRIEN W S 41591
O CONNELL R L *42338
O NEAL J D 42117
OBUCHI A *42038
ODA H *41552
ODAIRA T *41213, 41229, 41353, 41355, 41356, 41449, 41736, *41742, *41743, 41848, 41854, 41857, *41864, 41921, 41922, 41935, 41936, *41937, 42026, 42058, 42222, 42225, 42227, 42228, 42229, 42230, *42231, 42233, 42234, 42235, 42237, 42313, C42320, R42332, *42395, E NATI, ON. A, ug. 19, 70, 41, p.
ODANAKA H 41675
ODEN S *41282, *41938, *41996
OFUKA A 41527
OGDEN D 41632
OGDEN E C 41972, 41982, 41983
OGDEN W B 42270
OGITA H 42247
OGORODNIKOV B I *41838, 42077
OGURA K 41227, 41228
OHASHI T 42228, 42229, 42231, 42233, 42234, 42235, 42240
OHNO K 42051
OHRING G *41794
OKABE H 41750
OKABE T 42038
OKADA A 42352
OKAMURA M *41404
OKITA T 41278, 41802, *41865
OKUWAKI A 42038
OKUZAWA Y 42142
OLDENKAMP R D *41553
OLSSON R G *42039
OMATA K 41630
OMURA H *42068
ONOZUKA S 41213, 41742
OODAIRA T *42115
OOKI S *42069
ORCUTT J A 42206
ORMROD D P 42245, 42259
ORR J *41405
ORTIZ L W 41707
OSHIMA I *41406
OSHIMA R J *42232
OSHIMA T 41690
OSTROVSKIY O P *41407
OTA Y *42116
OTANI K 41365
OTSUKA K 41765
OTTERMAN J 41794
OTTO H *42199
OYA T 41630

P

PACARRERE P 41952
PAGE J K *41554
PALEOS J 41526
PALLAUF J 42146
PALM E W *42273
PALMA T V DE *41555
PALMER K *42303
PALMER R L 42275
PANAK B 41566
PANDOSH J P *41556
PANTSCHEV S *42086, *42087
PANZER J *41214
PAPETTI R A *42376
PARKER A *41215, 42188
PARKER G SR *41557
PARKER L C *41634
PARRY D W 4157[illegible]
PARUNGO F P *41971
PATE J B 41860
PAUTHENIER M *41684
PAVEK J 41270
PEABODY T E *41408
PEARCE D W *42304
PECHAN E H *42339
PEDLOW J W *41409
PEKLO P 41853
PELOSO A 41334
PENHA P D 42131
PENKETT S A *41939
PENQUITE C R 41565
PERKINS N M *41795
PERSSON C 41917
PERSSON G A *42377
PERVIER J W *41216
PETERA V *41912
PETRELLA P A JR 41220
PETRYANOV I V *42077
PFANNHAUSER W 42238
PFEIFFER J B 41344
PHELPS R E *41247
PIATT V R 41799
PICCHELAURI Y N *41677
PICHUKOV A P 41666
PICKROTH G *42202, *42203
PIERCE D P 41208
PIERCE J O 41243
PIEROVICH J M 41196

PIERRARD J M 41492
PINE L A 41574
PISKUNOV L I *42005
PITROU J *42285
PITTOCK A B *41940
PITTS J N JR 41924
PLANK C O 42224
PLASS W T *41410
PLATTE L R 42153
PLOECKINGER F *41411
PLUNGIS D *41248
POCIECHA Z *41277
PODZIMEK J 41847, *42011, *42012
POETZL K *41997
POLEK J R 41673
POLOCZEK J *41662
PONSONNET R 41494
POOLEY F D *42172
PORSCHE H *41412
PORUBA O 41664
POSPISCHIL M 41566
POSTEMA G A *41796
POTTER B H 41505
POTTER G H *41283
POUT C R 41611
POZIOMEK E J 41294
PRATAPAS J 41266
PRATHER R J *41413
PRESSELT N 42165
PRIKHOD KO V A 41310
PROKHOROV P S *42088
PROKOP M *41845
PROPST R C 41726
PRUGGMAYER D 41699
PRUSAKOV V M *41866
PRZYBOROWSKI GEB VONEND S 41833
PUESCHEL R F 41971
PURDOM P W *42340
PURI B R *41558, *41559

Q

QUARLES J *42314, *42315, *42316, *42341, *42342, *42343, *42344, *42345, *42346, *42347, *42348, *42349
QUIGG H T *41560

R

RAABE O G *42070
RABEN I A *41561
RABINOVICH J I 42082
RADUSHKEVICH L V *41685
RADZIMIRSKI S *41827
RAHN K A *41744
RANFT E L *41414, 41609
RANFT H 42261
RASCH R *41415
RATTRAY D T 42387
RAVAN J C *42317
RAVAN J E *42318, *42350
RAVOIRE J 42207
RAYNA J *41416
RAYNOR G S *41972, *41982, *41983
REAGAN J A *41836
REAY J S S *41883
REDKIN Y N *42078
REED L E 41980
REHER P 41342
REHN K H 42261
REHSI S S *41417
REINISCH K *42396
REINISCH R F 41924
REMENYI K *41265
RENNICK D F 42040
RENTNER J R 41748
REYNAUD P *41418
REZNIKOV Y N 41407
RHIM J S 42143
RHODES J R 41703
RICHTER J H *41941
RIESENFELD F C 41514
RIGDON L P 41777
RIGGLE C J 41882
RIGO H G *41562, *41563
RIMM A A 42153
RINDSBERGER M 42373
RIPPERTON L A *41867
ROBERTS N J *41745
ROBERTS R *42385
ROBERTSON J A *41419
ROBERTSON O B 41634
ROBIN E D 42122
ROBINSON J W *41746
RODIN E Y *41564
RODKEY F L *42117
ROEGENER H *41249
ROEHER O *42089
ROEHM W *41420
ROESSLER W U 41535
ROKAW S N 42155
ROL P K 42073
ROMANOF N 41957
ROSCHE P 41675
ROSE W 42312
ROSEN J M *41747
ROSENLUNG I T 41612
ROSMANITH J *42118
ROSS S W 41612
ROSSANO A T JR 41688, 41969
ROTE D M *41266
ROTH J F *41565
ROTH P M 42061
ROTTY R M *41973
ROWEDER G 41502
ROWELL R L 42084
ROWLAND J R 41941
ROYAL T M 41779
RUANE M F *42305
RUDERMAN M A 41979
RUEDINGER V *41217
RUFF J F 41797
RUFF R E *42351
RUMMEL R W *41267
RUSSELL J A *41250
RUSSELL V S *42397
RUTLEDGE R B 42102, 42130
RYLANDER R *42119
RYSCHKA J *41566
RYSZKA E *41663

S

SACHSE J *41421, *41422
SACKS R D *41748
SADEH W Z *41797
SAIJO T 41884
SAITO H *41635
SAITO K *41884
SAITO T *41749, 41898
SAKABE O *41423
SAKAI T 41785
SAKAMOTO Y 41727
SAKANISHI J *41567
SAKOL S L *41424
SAKURAI H *42120
SALICK B 42162
SAMPLES W R 41688
SANAI G H *42151
SANJOUR W 42339
SANSONI B *41828
SAPUNOV G S 41698
SARGENT F H *42200
SARMA A C 42286
SAROFIM A F 42392
SARUTANI T 41406
SASAKI K *41268, *41568
SATO A 41904
SATO S *41425
SAVCHENKO A V *41974
SAWADA T *41218, 41322, 42212, 42222, 42225, 42228, 42229, 42231, *42233, *42234, *42235, 42237, 42240
SAXENA U K 41976
SAYRE J W 42104
SCHAUER W *41569
SCHEEL L D 41193
SCHIENE H *41426
SCHLEGEL H *42173
SCHLESINGER W H *41942
SCHLISING R A 41998
SCHOELZKE D 41731
SCHOERMANN J 41718
SCHONBERG M 41870
SCHOUW A C *41636
SCHOWALTER K A *41427
SCHRIEWER M 41219
SCHUCKMANN F *42174
SCHULENBERG F *41570
SCHULTS W D *42324
SCHUSTER E *41571
SCHUTZ H *41428
SCHWANECKE R *41429
SCHWARTZ R A 41424
SCHWARTZ W A 41216
SCHWARTZ W E 41882
SCHWARZ F P *41750
SCHWARZ M 41209
SCHWARZBAUER G *41430
SCHWEERS W H M *41431
SCHWINKOWSKI K 41859
SCOTT D S *42040
SCRASE T A *41572
SEBASTIEN P *42152
SEBAYASHI T *42041
SEBBORN W S *41798
SEEBACH E *41432
SEHMEL G A *42071
SEILER W *41943
SEINFELD J H 42061
SEINO S 41278
SEKINE I 41268
SELMECZI J G *41433
SEMRAU K *41434
SENBA K 41622
SENKO E E 42001
SERGEEVA T I 42141
SERGEEVA Z N 42141
SESKIN E P 42149
SHACKLETTE H T 42392
SHAIR F H 41711
SHARER J C 41508
SHARMA M M 41676
SHAW R W 41947
SHEESLEY D C 41860
SHEN T T *41751
SHENFELD L *41984
SHERBINSKY M *41269
SHIDARA M 41630
SHIGEMO Y *41898
SHIMADA S 42142
SHIMAGUCHI S *42352
SHIMAZAKI M 41527
SHIMIZU T *42121
SHIMO M 41876
SHINOZAKI Y 41736
SHINTANI M 41922
SHINTANI T 41765

SHKODINA V G 41666
SHUGAYEV B B *42190
SHULTS W D 41764
SHUM Y S *41868
SHVAYKO I I *42175
SIDEY M M 41728
SIEMER D 41735
SIGSBY J E 41770
SILVERMAN L 41688
SIMKO A O *41573
SIMONS J R *42122
SINHA R K *41637
SISSONS B *41251
SITALO E A 41838
SKITOVICH V I 41838
SLADKOVIC R 41997
SLIGER A G 41360
SLINN W G N 41955
SLOAN M F 42125
SLONAKER J F *41435
SMALLEY W M 41535
SMALLWOOD H 42402
SMIRNOV V V 41790, 41974
SMITH G L *41975
SMITH J P *42042
SMITH P H *41436
SMITH W B 41384
SMITH W M *41574
SMITHERMAN J B *41437
SMOKTIY O I 41931
SMOLIK J *42090
SNEDDEN R 41385
SNOW A 42300
SNYDER D J III *42353, *42354, *42355
SNYDER R W 41323
SOCHTING U 42246
SOFUKU M 41862, 42026, *42043, 42058
SOLOWJOWA T V 42000
SOTOLA F *41270
SPANO L A 41210
SPECK G 41814
SPEDDING D J *42289
SPEICH P *41438
SPENDLOVE C *42204
SPENGLER G *41219
SPERANSKIY S V *42123
SPICER C W 41882
SPICER S S *42124
SPIEGEL R J 41836
SPIELMAN L A 42021
SPURNY K 41841
SQUIRES B J *41439
SRIVASTAVA J P *41440
STAMULIS A *41799
STANNERS J F *42292
STARIKOV B G 42001
STEGLICH W 42089
STEGMAN C G 41553
STEIMLE F *41575
STEINBERG M *41576
STEINHAUER W G 41927
STEPHENS E R *41885
STEPHENS N T 42375
STEPHENS R E *41441
STEPHENS R J *42125
STEPHENSON G R 42245
STEPINSKI W *42309
STERBIS E E *42079
STERN H I *41220
STETTLER R J *41442
STEUBING L *42236
STEVENS D W *41800
STEWART E B 42153
STEWART R D *42153
STOCK D E *41577
STONE R *42402
STOTZKY G 42157
STOVER W A 41504
STRANGE J P *41818
STRAUBEL H *42044
STRELOW R *42356
STROKIN V N *42045
STUIK E J *42126
STUKEL J J 41562
STUMPP G *41837
STYRO B I *42006
SUGA K *41578
SUGAI R 41865
SUGATA S 42218, 42228
SUGIMAE A *41752
SUGIOKA M *42046
SUGITA M 42120
SULLIVAN K M *42047
SUTUGIN A G 41840
SUZUE S 41624
SUZUKI T 41802
SVIDRNOCH L *41664
SVORE J H *42357, *42358, *42359
SWANSON E S *42252
SWEARINGEN T B *41579
SWINNERTON J W *41944
SYCZEWSKA K 41654
SZARAWARA J *41638
SZWED H *41639, *41665

T

TABATA N 41383, *41443
TADMOR J *41252
TADO H 41643
TAGAWA K *41580
TAGER S A *41581
TAJIMA N *41753
TAJIMA T 41878
TAKAGI M 41928
TAKAHASHI A 41289, *41754
TAKAHASHI M *41869, 41898, 41904
TAKAHASHI S 41211
TAKAHASHI T *41582, 41898
TAKANO K 41291
TAKAOKA M 41733
TAKAURA Y *41444
TAKECHI H 41622
TAKEDA S 41582
TAKEMOTO K 42253
TAKENOBU M 42276
TAKESHI G *41755
TAKHIROV M T *42127
TALMI Y *41756
TAMURA Z 41519
TANABE K 42253
TANAKA K 41211, 41784
TANASESCU G *42128
TANG S 42063
TAPPEL A L 42161
TARASOV S I 42005
TARAT E Y 41310, *41666
TARKOW H 41196
TASHIRO K *42253
TATE A L *42254
TATTERSON B F *41640
TATUM D *41583
TAUSSIG J K JR *42378
TAYAMA I *41445
TAYLOR B W 41368
TAYLOR O C 42242, 42244, *42255
TAYLOR R C 41799
TEISINGER J *42191
TELLER A J *41584
TEMPLETON R E *42297
TERAKADO K 42228, 42231, 42235
TEVAULT D E *42048
THEODORE J 42122
THOMAS G *41253
THOMAS R L 42070
THOMPSON R J 41777
THOMPSON S P 41579
THOMSON W W 42252
THORMANN K 41489
THORNBURGH W F 41414
THORNTON C A 42102
THUERMER H *41846
TILLERY M I 42070
TIMOSHENKO V I *42049
TING I P 42213
TITUS H J *41446
TODOMATSU T *41945
TOMAIDES M *41686, *42311
TOMCSANYI G *41221
TOMMERDAHL J B 41779
TOONKEL L 41870
TOSH J D 41250
TOYAMA S *42237
TRAIN R E *41447, *42319, *42360, *42361
TRAPP G 42136
TREMPU R *41585
TRENKLER H *41222
TRIPATHI R K *42290
TROY W *42390
TRUFAKIN V A 42001
TSAO K C *41976
TSCHENG S H 41591
TSELUKYO Y I 41407
TSUCHIYA K 42120
TSUKADA S 41862, 41869
TSUKADA T 41862, 42058
TSUKAMOTO Y 41227, 41228
TSUNODA T 41203, *41448
TSUTSUMI M 42068
TSUTSUMI T 41850
TSVETKOVA I N 42175
TUBOLKIN A F 41310
TUMA J *41687
TURKDOGAN E T 42039, *42050
TURPIN R A *41998

U

UDDIN D E 42117
UEHARA H *41757
ULLMAN W 41833
UNANGST P C 41398
UNLAND M L *42072
UNO Y 42265, 42266, 42267, *42268
URBANOWICZ H *42192
URONE P 42042
USAMI S *42051
USHIJIMA S 42142
UTAGAWA M 41355, *41449, 41722, 41922, *42320
UTSUNOMIYA M *42362

V

VAGNER L 41566
VALIC F *42176
VALITOV N K *42052
VAN AKKEREN R A C 41366
VAN AS A 42097
VAN DER HOVEN I *41977
VAN FRAGSTEIN J G 42199
VAN GORDON D *41450
VAN MEURS H C A 41515
VAN NATTA F C 42162
VAN YSERLOO B 42153
VAN ZUIDEN L 42015
VANCINI C A *41586
VARDARO P M 42249

VARDE K S *41451
VEJVODA J *41587
VERDOUW A J 41442
VERSINO B *41758
VIEHRIG J *41452
VIL YANOV V M *41759
VILADAS J M *42391
VILLA S *41588
VILLALOBOS R *41801
VINOGRADOV B V *41829
VINSON D J 41617
VINTERS J V 42050
VOLCHOK H L *41870
VOLDAYEVA I I 41231
VOLF J 42166
VOLFOVA E *42013
VOLSICKY Z *41223
VON HEUSDEN S 41796
VOROS L 41265
VOSS A *42298
VRKOCOVA J *41847
VRTEK J 41270
VYAS K C 41304

W

WACKS K *41453
WADA O *42129
WADDEY W E 41305
WAFELMAN H R *41760
WAGNER J C *42205
WAGNER W R *41589
WAID D E *41667
WALDRON A W JR *41999
WALKER P L JR 41637
WALLACE N D 42102, *42130
WALLIN T *41224, *42256
WALTHALL J H *41680
WANG I T 41266
WANGEN L 41266
WANIE W *41454
WANTA R C *41946
WARDELL J R JR 42124
WARTBURG A F 41860
WASILEWSKA J 41275
WATANABE I *41278, *41802
WATANABE K 41849
WATANABE M 42113
WATANABE T *41225, 41289, *41761
WATANABE Y 41922
WAYNE L G *42206
WEAVING J H *41590
WEBER J *42269
WEBSTER I 42097
WEILERSTEIN G 41236
WEINBERG F J 42014
WEINER B 42158
WEN C Y *41591
WENNER J G *41592
WENZEL D G 42159
WERLE D K *42091
WERTHAMER S *42131
WEST P W *41762
WHEATON W L *41763
WHELPDALE D M *41947
WHITBY K T 41871
WHITE J C *41764
WHITE R K *41830
WHITEHEAD T P *42177
WHITEHOUSE M W 42162
WHITMYER A *41593
WHITTAKER J K 41750
WHITTEMORE R C *41455
WIEMER J 41524
WIESENTHAL P V *41668
WILKES J O 41926
WILKINSON J S 41546
WILLEKE K *41871
WILLIAMS F W 42037
WILLIAMS G *41803
WILLIAMS T M *41641
WILSON F C *41456
WILSON J G *41457
WILSON W C *41594
WILSON W I 42057
WINCHESTER J W 41897
WINDELS G 41744
WISELY F E *41595
WITHERSPOON R *42386
WITZKY J E *41226
WIXSON B 42260
WIXSON B G 41243
WOERLE R 41219
WOIDICH H *42238
WOJCIECHOWSKI J *41905
WOLF F *42053
WOLF M A 41955
WOLFORD R G 42143
WOOD C 42383
WOODRIFF R 41735
WORTH J J B 41867
WOTRING W T 41323
WROBEL J 41665
WU Y *41642
WYNDER E L *42193

Y

YAGI S 41443
YAKOWITZ H *41819
YAMAGUCHI M 41850
YAMAMOTO H 41898
YAMAOKA K *41643
YAMASAKI M *42257
YAMATE N *42054, *42055
YANAGIHARA S *42056
YANAGISAWA M 42111
YANAKA T 41865
YANAMI M 41849, 41850
YANASE S 41622
YANG R T *42057
YANO S *41765
YASUE G *41766
YATES J T JR 42034
YAVOROVSKAYA S *41820
YEH H C *41458, *41459
YEMEL YANOV M F 41677
YEMEL YANOV Y M 41677
YENCHA A J 42035
YOBS A R *42178
YOKOGAWA T 41395
YOKOTA H 41862, 42026, *42058
YOKOTA Y 42101
YOKOYAMA T *42132
YOKOYAMA Y 41203, 41448
YONEDA H 41877
YONEYAMA T 42212, 42235, *42239, *42240
YORK J L 41926
YOSHIDA H 41727
YOSHIDA K *41227, *41228
YOSHIDA R *42133
YOSHIOKA O 41527
YOSHIZUMI K *41229, *41230, *41767, *41768
YOSIM S J *41596
YUKITAKE T *41460
YURIY Y 41677

Z

ZAFONTE L 41924
ZAIKA P K 41231
ZAMBAKAS J D 42098
ZAMFIR G *42179
ZARKOVIC G *42180
ZEILINGER K 41569
ZELLER M V *41769
ZEMBOK A 41662
ZERMIZOGLOU R *41461
ZHAKENOVA R K 42137
ZHUKOV V I *41231
ZIAI N 42151
ZIEGLER H 42216
ZIELHUIS R L *42194
ZIKRIA B A *42181
ZIMINA L A 42077
ZOERNER K H *41831

ORDER FORM

USE RESTRICTED AS INDICATED IN THE INTRODUCTION

SEND TO:

ENVIRONMENTAL PROTECTION AGENCY
AIR POLLUTION TECHNICAL INFORMATION CENTER
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

Date ______________________

Name ______________________

Program ______________________

Address ______________________

THIS FORM IS TO BE USED FOR ORDERING MICROFICHE DUPLICATES. INDICATE THE ARTICLES YOU REQUIRE BY CIRCLING THEIR APTIC NUMBERS. IF YOU DO NOT HAVE ACCESS TO A MICROFICHE READER, YOU MAY REQUEST PAPER COPIES. HOWEVER, MICROFICHE CAN USUALLY BE PROVIDED IN ABOUT 1/5 THE TIME REQUIRED TO PROVIDE PAPER COPIES.

61065 61066 61067 61068 61069 61070 61071 61072 61073 61074 63410 63411 63412
63413 63414 63415 63416 63417 63418 63419 63420 63421 63422 63423 63424 63425 63426
63427 63428 63429 63431 63432 63433 63435 63436 63437 63438 63439 63441 63442 63443
63444 63445 63446 63447 63448 63449 63450 63451 63452 63453 63454 63455 63456 63457
63458 63459 63460 63461 63462 63463 63464 63465 63466 63467 63468 63469 63470 63471
63472 63473 63474 63475 63476 63477 63478 63479 63480 63482 63483 63484 63485 63486
63487 63488 63489 63490 63491 63492 63493 63494 63495 63496 63497 63498 63499 63500
63501 63503 63504 63505 63506 63507 63508 63509 63510 63511 63512 63513 63514 63515
63516 63517 63518 63519 63520 63521 63522 63523 63524 63525 63526 63527 63528 63529
63530 63531 63532 63533 63534 63535 63536 63537 63538 63539 63540 63541 63542 63543
63544 63545 63546 63547 63548 63549 63550 63551 63552 63553 63554 63556 63557 63558
63559 63560 63561 63562 63563 63564 63565 63566 63567 63568 63569 63570 63571 63572
63573 63574 63575 63576 63577 63578 63579 63580 63581 63582 63583 63584 63585 63586
63587 63588 63589 63590 63591 63592 63594 63595 63596 63597 63598 63599 63600 63601
63602 63603 63604 63605 63606 63607 63608 63609 63610 63612 63613 63614 63615 63616
63617 63618 63620 63621 63622 63623 63624 63625 63626 63627 63628 63630 63631 63632
63633 63634 63635 63636 63637 63638 63639 63640 63643 63644 63645 63646 63647 63648
63649 63650 63651 63652 63653 63654 63655 63656 63657 63658 63659 63660 63661 63662
63664 63665 63666 63667 63668 63669 63670 63671 63672 63673 63674 63675 63676 63677
63678 63679 63680 63681 63682 63683 63684 63686 63687 63688 63689 63690 63691 63693
63694 63695 63696 63697 63698 63699 63700 63701 63704 63705 63706 63707 63708 63709
63710 63711 63712 63713 63714 63715 63716 63717 63718 63719 63720 63721 63722 63723
63724 63725 63726 63727 63728 63729 63730 63731 63732 63733 63734 63735 63736 63737
63738 63739 63740 63741 63742 63743 63744 63745 63746 63747 63748 63749 63750 63751

63752 63753 63754 63755 63756 63757 63758 63759 63760 63761 63762 63763 63765 63766
63767 63768 63769 63770 63771 63772 63773 63774 63775 63776 63777 63778 63779 63780
63781 63782 63783 63784 63785 63786 63787 63788 63789 63790 63791 63792 63793 63794
63795 63796 63797 63798 63799 63800 63801 63802 63803 63804 63805 63806 63807 63808
63809 63810 63811 63812 63813 63815 63816 63817 63818 63819 63820 63821 63822 63823
63824 63825 63826 63827 63828 63829 63830 63831 63832 63833 63834 63835 63836 63837
63838 63839 63840 63841 63842 63843 63844 63845 63846 63847 63848 63849 63850 63851
63853 63854 63855 63856 63857 63858 63859 63860 63861 63862 63863 63864 63865 63866
63867 63868 63869 63870 63871 63872 63873 63874 63875 63876 63877 63878 63879 63880
63881 63882 63883 63884 63885 63886 63887 63888 63889 63890 63891 63892 63893 63894
63895 63896 63897 63898 63899 63900 63901 63902 63903 63905 63906 63907 63908 63909
63910 63911 63912 63913 63914 63915 63916 63917 63918 63919 63920 63921 63922 63923
63924 63925 63926 63927 63928 63929 63930 63931 63932 63933 63934 63935 63936 63937
63938 63939 63940 63941 63942 63944 63945 63946 63947 63949 63950 63951 63952 63953
63955 63956 63957 63958 63959 63960 63961 63962 63963 63964 63965 63966 63967 63968
63969 63970 63971 63972 63973 63974 63975 63976 63977 63978 63979 63980 63981 63983
63984 63985 63986 63987 63988 63989 63990 63991 63992 63994 63995 63996 63997 63998
63999 64000 64001 64002 64003 64004 64005 64006 64007 64008 64009 64010 64011 64012
64013 64014 64015 64016 64017 64018 64019 64020 64021 64022 64023 64024 64025 64026
64027 64028 64029 64030 64031 64032 64033 64034 64035 64036 64037 64038 64039 64040
64041 64042 64043 64044 64045 64046 64047 64048 64049 64050 64051 64052 64054 64055
64056 64057 64058 64059 64060 64061 64062 64063 64064 64065 64066 64067 64068 64069
64070 64071 64072 64073 64074 64075 64076 64077 64078 64079 64080 64081 64082 64083
64084 64085 64086 64087 64088 64089 64090 64091 64092 64093 64094 64095 64096 64097
64098 64099 64100 64101 64102 64103 64104 64105 64106 64107 64109 64110 64111 64112
64114 64115 64116 64117 64118 64119 64120 64122 64123 64124 64125 64126 64127 64128
64129 64130 64131 64132 64133 64134 64135 64136 64137 64138 64139 64140 64141 64143
64144 64145 64146 64147 64148 64149 64150 64152 64153 64154 64155 64156 64157 64158
64159 64160 64161 64163 64164 64165 64166 64167 64169 64171 64172 64174 64175 64176
64177 64178 64179 64180 64181 64182 64183 64184 64185 64186 64187 64188 64189 64190
64191 64192 64193 64194 64195 64196 64197 64198 64199 64200 64201 64202 64203 64204
64205 64206 64207 64208 64209 64210 64211 64212 64213 64214 64215 64216 64217 64218
64219 64220 64221 64222 64225 64226 64227 64228 64229 64230 64231 64232 64233 64234
64235 64236 64238 64239 64240 64241 64242 64243 64244 64245 64246 64247 64248 64249
64250 64251 64252 64253 64254 64255 64256 64257 64258 64259 64260 64267 64268 64269
64271 64273 64274 64275 64278 64279 64280 64281 64282 64283 64284 64285 64286 64287
64288 64289 64290 64291 64292 64293 64294 64295 64296 64297 64298 64299 64300 64301
64302 64303 64304 64305 64306 64307 64308 64309 64310 64311 64313 64314 64315 64316
64317 64318 64319 64320 64321 64322 64323 64325 64326 64327 64328 64329 64330 64331
64332 64333 64334 64335 64336 64337 64338 64339 64340 64341 64342 64343 64344 64345
64346 64348 64349 64350 64351 64352 64353 64354 64355 64357 64358 64360 64361 64362
64363 64364 64365 64366 64367 64368 64369 64370 64371 64374 64375 64376 64377 64378
64379 64380 64381 64382 64383 64384 64385 64386 64387 64388 64389 64390 64391 64392
64393 64394 64395 64396 64397 64398 64399 64400 64401 64402 64403 64404 64405 64406
64407 64408 64409 64411 64412 64413 64414 64415 64416 64417 64418 64419 64420 64421
65001 65002 65003 65004 65005 65006 65007 65008 65763 65764 65765 65766 65767 65768
65769 65770 65771 65772 65774 65775 65776 65777 65778 65779 65780 65781 65782 65783
65784 65785 65786 65787 65788 65789 65790 65791 65792 65793 65794 65795 65796 65797
65798 65799 65800 65801 65802 65803 65804 65805 65807 65808 65809 65810 65811 65812
65813 65814 65815 65816 65817 65818 65819 65820 65821 65822 65823 65825 65826 65827
65829 65830 65831 65832 65833 65834 65837 65838 65839 65845 65846 65847 65848 65849
65850 65851 65852 65853 65854 65855 65856 65857 65858 65859 65860 65861 65862 65863
65864 65868 65869 65870 65871 65873 65874 65875 65876 65877 65878 65879 65880 65881
65882 65883 65884 65885 65886 65887 65888 65889 65890 65891 65892 65893 65894 65895
65896 65897 65898 65899 65900 65901 65902 65903 65904 65905 65906 65907 65908 65909
65910 65911 65912 65913 65914 65915 65916 65917 65918 65919 65920 65921 65922 65923
65924 65925 65926 65927 65928 65929 65930 65931 65932 65933 65934 65935 65936 65937

65938 65939 65940 65941 65942 65943 65944 65945 65946 65947 65948 65949 65950 65951
65952 65953 65955 65956 65957 65958 65959 65960 65961 65962 65963 66027 66028 66029
66031 66032 66033 66034 66035 66036 66037 66038 66039 66040 66041 66042 66043 66044
66045 66046 66047 66048 66049 66050 66051 66052 66053 66054 66055 66056 66057 66058
66059 66060 66061 66062 66063 66065 66067 66068 66069 66070 66071 66072 66073 66074
66075 66076 66077 66078 66080 66081 66082 66083 66084 66085